

UNIT 1 – BASIC BIOCHEMISTRY AND CELL ORGANISATION**MARK SCHEME****GENERAL INSTRUCTIONS**Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark.

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 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)	peptide bond (1)	1			1		
		(ii)	Palmitic acid – glycine - histidine - lysine (2) Any two in correct order (1)		2		2		
		(iii)	palmitic acid (1)	1			1		
	(b)	(i)	collagen is a single polypeptide chain (1) which has been coiled into an alpha helix (1) tropocollagen is composed of {three / 2 or more} polypeptide chains bonded together (1)	3			3		
		(ii)	folding of molecule into a globular shape due to bonding/ interactions between R groups(1)	1			1		
			Question 1 total	6	2	0	8	0	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	Approximately 20 amino acids (1) allow: 20 to 27	1			1		
		(ii)	only 4 different bases so 1 or 2 bases could not code for all 20 amino acids/ OWTTE (1) a three base system could code for 64 amino acids (1)	2			2		
	(b)	(i)	Methionine, valine, glutamic acid, aspartic acid, valine, aspartic acid all correct = 3 marks one incorrect = 2 marks two incorrect = 1 mark three incorrect = 0 mark	2			2		
		(ii)	TAC CAA CTT CTA CAA CTG all correct = 2 marks one incorrect triplet = 1 mark two incorrect triplets = 0 marks	2			2		
		(iii)	Any four from: DNA helicase uncoils DNA (1) RNA polymerase separates/ breaks H bonds (1) Exposed DNA bases acts as a template (1) Complementary base pairing (1) RNA polymerase attaches free nucleotides to mRNA strand(1)	4			4		
	(c)		The mutation from GAU to GAC codes for the same amino acid (1) Therefore same primary structure of protein (1)			2	2		
Question 2 total				11	0	2	13	0	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	Lock and key and induced fit (1)	1			1		
		(ii)	Lower the activation energy/eq (1)	1			1		
	(b)		competitive inhibition (1) iron sulphate could have a shape similar to the substrate/complementary to the active site of glucosyl transferase (1) Fit/ bind into the active site (1) Prevent the {substrate molecule/ sucrose} entering the active site/blocks the active site (1)	2	2		4		
	(c)		(Add iron sulphate to toothpaste / mouthwash / sugary drinks.) to prevent formation of plaque / tooth decay. (1)		1		1		
			Question 3 total	4	3	0	7	0	0

Question			Marking details		Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)		P = Mitochondrion and Q = nucleus (1) Any one from		2			2		
			Mitochondrion / Organelle shown	Nucleus						
			inner membrane is folded / has cristae	No folding of inner membrane / no cristae (1)						
			no ribosomes attached	ribosomes attached (1)						
	(b)		14/32 500 x1000 (1) =0.43076.....µm(1) 0.431 µm (1) 3sig.fig.			3		3	3	2
	(c)	(i)	Radius = 0.6 (1) 2 x 3.14 x 0.6 (9.8+0.6)(1) =39.19 (µm ²)(1)			3		3	3	
		(ii)	Diffusion distance to centre is smaller (1) Larger surface area / SA:Vol bigger (1) Accept converse More {oxygen can diffuse in / CO ₂ diffuse out} (1) <u>Aerobic</u> respiration is <u>more</u> efficient / <u>more</u> ATP produced (1)				4	4		
			Question 4 total		2	6	4	12	6	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			Mitosis (1) A Anaphase B Prophase C Telophase D Metaphase all correct = 3 marks one incorrect = 2 marks two incorrect = 1 mark three or four incorrect = 0 marks	1			4		
					3					
	(b)	(i)		Interphase (1) This is the longest stage (1)	1		1	2		
		(ii)		Count more cells in this specimen(1) View more specimens (1)		2		2		2
				Question 5 total	5	2	1	8	0	2

GCE AS and A LEVEL BIOLOGY Specimen Assessment Materials 142

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
6	(a)			447.7 - 329.3 = 118.4 (1) 118.4 / 447.7 x 100 = 26.4 % (Acc 26) (1)		2		2	2		
	(b)			Ethanol dissolves phospholipids / denatures proteins (1) Creates gaps in the membrane (1)		2		2			
	(c)			Increased temperature increases KE of membrane and dye molecules(1) Increased movement of membrane molecules increases the number and size of gaps in membrane (1) More dye molecules can escape from cells (1)			3	3			
	(d)			Any two from At 45°C {repeat results vary greatly / range from 99 to 215 seconds} (1) Only three temperatures were investigated (1) Could be several shades of red/ no standard red colour used/ red colour not quantified(1)			2	2			2
				Question 6 total	0	4	5	9	2	2	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)		Increases (contact) time between enzymes and substrate (1) More successful collisions/more enzyme substrate complexes formed (1)		2		2		2
	(b)	(i)	40°C to 60°C decrease in volume of fruit juice extracted (1) Above/at 60°C no juice extracted (1) Between 40°C to 60°C enzymes are denaturing / at 60°C they are denatured/ above 40 °C hydrogen bonds breaking (1) {Tertiary structure deformed / active site changes shape} {so substrate can no longer fit active site/{no/fewer} enzyme substrate complexes formed} (1)		4		4		
		(ii)	(Free enzymes) can move (1) Increased chance of successful collision / more enzyme substrate complexes formed(1) allow converse		2		2		
		(iii)	(Increased juice extracted with membrane bound enzymes) because membrane bound enzymes are directly exposed to substrate (1) (Enzymes immobilised inside bead) substrate has to {diffuse/pass} into bead (1)		2		2		
		(iv)	Use enzymes bound to a gel membrane at 60°C(1) Highest yield compared to free and encapsulated enzyme(1) Use many pieces of gel membrane to increase surface area(1) Slow flow rate to increase contact time for formation of enzyme substrate complexes (1)			4	4		4
Question 7 total				0	10	4	14	0	6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8			<p>Indicative content</p> <p>Many proteins are made of several polypeptide chains that are bonded together to form a quaternary structure. Therefore, several genes must be involved to carry the information for a single protein because one gene would be needed for each polypeptide chain. This is called the one gene – one polypeptide hypothesis.</p> <p>All proteins are synthesised as a chain of amino acids which is called its primary structure. The primary structure needs to be folded and held in place by hydrogen bonds and interactions between variable groups. Therefore the polypeptide requires further processing to produce a functional protein.</p> <p>In addition, some proteins have additional functional groups added, eg, haem in haemoglobin or have carbohydrate groups attached eg, antigens involved in cell recognition.</p> <p>Ribosomes are only involved in translating the code carried by mRNA molecules. Endoplasmic reticulum is also needed to transport the polypeptide chains to Golgi bodies which then further process them to produce the final protein. Golgi bodies also package these proteins in liposomes or secretory vesicles so that they can be transported to their site of action inside or outside cells.</p>		9		9		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>7-9 marks</p> <p>The candidate clearly and correctly explains that proteins that have a quaternary structure must be composed of more than one polypeptide chain and that more than one mRNA molecule would therefore be needed. Clear reference to splicing several mRNA sequences is also included. The candidate also explains the role of Golgi bodies in further processing of polypeptides to form fully functional proteins and the fact that many proteins require the addition of other functional groups post-translation to become fully functional. The additional role of Golgi bodies in preparing the functional protein for secretion via secretory vesicles is also described.</p> <p><i>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.</i></p> <p>4-6 marks</p> <p>The candidate's response makes references to some proteins having a quaternary structure and therefore the need for more than one gene to code for the functional protein. Some reference to exons and introns is made but may not be clearly linked to the concept of more than one mRNA sequence being spliced to produce the translatable mRNA molecule. The role of Golgi bodies is described correctly in terms of further processing of polypeptides and some reference is made to examples of proteins that include functional groups which are added post-translation. Some indication of the role of Golgi bodies in preparing proteins for secretion is also included.</p>						

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
				<p><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> <p>1-3 marks Some reference is made to proteins with a quaternary structure needing more than one gene to produce the functional protein but little or no correct description is given as to the production of several mRNA sequences from the exons that are spliced to produce the translatable mRNA molecule. Reference to post-translation processing by Golgi bodies is limited to glycosylation with no or little link made to the need for the polypeptide to be processed to assume its functional secondary, tertiary or quaternary structure. Some indication is made of the role of Golgi bodies in producing vesicles that contain proteins for secretion.</p> <p><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></p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>							
				Question 8 total	0	9	0	9	0	0	

UNIT 1: Basic Biochemistry and Cell Organisation - SUMMARY OF ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	2	0	8	0	0
2	11	0	2	13	0	0
3	4	3	0	7	0	0
4	2	6	4	12	6	2
5	5	2	1	8	0	2
6	0	4	5	9	2	2
7	0	10	4	14	0	6
8	0	9	0	9	0	0
TOTAL	28	36	16	80	8	12