

Question			Answer	Marks	Guidance
1	(a)	(i)	<u>N</u> ;	1	IGNORE nitrogen DO NOT CREDIT n or N ₂
	(a)	(iii)	polypeptide / protein ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks IGNORE peptide
	(a)	(iii)	<p><i>name</i></p> <p><u>peptide</u> (bond / link) ;</p> <p>plus any two from ...</p> <p><i>description of formation</i></p> <p>between, amine group (of one amino acid) and carboxyl group (of another) ;</p> <p>H (from amine) combines with OH (from carboxyl) ;</p> <p>condensation (reaction)</p> <p>OR</p> <p>water, lost / eliminated / produced / created / AW ;</p>	3 max	<p>Maximum two marks for description. Name must be given to award 3 marks.</p> <p>ACCEPT marking points from diagram where amine and carboxyl groups are clearly labelled.</p> <p>Mark writing first then look at diagram.</p> <p>If diagram contradicts creditable text award maximum one mark for description.</p> <p>DO NOT CREDIT dipeptide</p> <p>ACCEPT phonetic spellings of amine and carboxyl</p> <p>ACCEPT 'carboxylic acid' and 'amino'</p> <p>DO NOT CREDIT amide / carbonyl</p>

Question			Answer	Marks	Guidance
1	(b)	(l)	<p>V1 <u>high latent heat</u> of vaporisation / large amount of energy required to change from liquid to gas / AW ;</p> <p>V2 <u>evaporation</u> is (efficient) cooling mechanism / AW ;</p> <p>V3 example of cooling in living organism ;</p> <p>H1 high specific heat capacity / large amount of energy needed to, raise / change, temperature ;</p> <p>H2 (thermally) stable environment for, aquatic / named aquatic, organisms ;</p> <p>H3 (aquatic) organisms use less <u>energy</u> on temperature control ;</p> <p>H4 (internal) temperature of organisms changes only slowly ;</p> <p>H5 (biological) reactions / enzymes / metabolism, function(s) correctly ;</p> <p>F1 ice, is less dense than water / floats ;</p> <p>F2 (surface of) ice provides habitat for, organisms / named organism ;</p>	8 max	<p>Annotate property (number 1) marks with <input checked="" type="checkbox"/> 1 symbol to help distinguish marks for QWC</p> <p>All marks are stand alone</p> <p>V1 ACCEPT 'large amount of heat needed...'</p> <p>V1 ACCEPT 'high latent heat of evaporation'</p> <p>V2 ACCEPT 'evaporation removes heat from body'</p> <p>V3 e.g. sweating, panting, transpiration (as cooling)</p> <p>'high latent heat of evaporation means sweat cools you down' = 3 marks</p> <p>H1 ACCEPT 'water / it, is thermally stable'</p> <p>H1 ACCEPT 'water is slow to change temperature'</p> <p>H1 CREDIT 'the temperature of the sea does not change much'</p> <p>H2 'thermally' can be inferred from previous statement</p> <p>H5 IGNORE 'organisms function correctly'</p> <p>F1 ACCEPT 'maximum density is at 4°C'</p> <p>F2 e.g. 'polar bears on ice'</p>

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	<p>I1 water (beneath ice), insulated / remains liquid / doesn't freeze ;</p> <p>I2 (aquatic) organisms, do not freeze / can still swim ;</p> <p>S1 (effective) solvent ;</p> <p>S2 medium for reactions / (internal) transport medium / able to dilute toxic substances ;</p> <p>C1 cohesion / adhesion ;</p> <p>C2 example of cohesion / adhesion, in living organism ;</p> <p>T1 surface tension ;</p> <p>T2 habitat for (named) invertebrates ;</p> <p>P1 transparent ;</p> <p>P2 allows underwater photosynthesis ;</p> <p>D1 idea of high density ;</p> <p>D2 allows flotation / support ;</p> <p>U organisms can still obtain, oxygen / (named) minerals / food / carbon dioxide, from water ;</p>		<p>I2 IGNORE unqualified references to survival</p> <p>I2 ACCEPT gametes / AW, can be dispersed</p> <p>C2 e.g. transpiration stream / apoplast movement</p> <p>C2 ACCEPT descriptions</p> <p>T2 ACCEPT insects IGNORE animals</p> <p>P2 ACCEPT other example of transparency linked to survival, e.g. eyes</p> <p>D1 IGNORE references to viscosity</p> <p>U not linked to a single property and so cannot contribute to QWC</p> <p>U IGNORE nutrients / nutrition</p>

Question			Answer	Marks	Guidance
			QWC: a property mark (with number 1) and a survival mark with the same letter seen twice.	1	e.g. H1 and H3 and S1 and S2

Question			Answer	Marks	Guidance
	(b)	(i)	<p>1 protein <u>secondary</u> structure / α-helix / β-pleated sheet ;</p> <p>2 (protein) <u>tertiary</u> structure ;</p> <p>3 between polypeptide chains in (named) quaternary structure ;</p> <p>4 (between chains of) cellulose ;</p> <p>5 (between, strands of / bases in) DNA ;</p> <p>6 AVP ; ; ;</p>	3 max	<p>Mark the first answer on each prompt line.</p> <p>3 e.g. between adjacent chains in collagen</p> <p>CREDIT 'protein / named protein / enzyme' OR 'between amino acid R-groups' once ONLY if <u>none</u> of mps 1-3 have been awarded</p> <p>4 IGNORE macrofibrils</p> <p>6 e.g. between mRNA and tRNA binding between enzyme and substrate (coiling of) amylose between DNA and mRNA during transcription</p>
			Total	17	

Question		Answer	Marks	Guidance
2	(a)	<p>regulates fluidity of / stabilises / AW, membranes / phospholipid bilayer ;</p> <p>(converted to) steroid / named steroid, hormone(s) ;</p> <p>waterproofing the skin ;</p> <p>making Vitamin D ;</p> <p>making bile (salts) ;</p>	2 max	<p>Mark the first answer on each prompt line.</p> <p>ACCEPT decreases / maintains, fluidity</p> <p>ACCEPT supports structure of membranes</p> <p>DO NOT CREDIT makes membrane rigid</p> <p>DO NOT CREDIT allows / increases fluidity</p>
	(b) (i)	<p>contains C and H and O ;</p> <p>has, OH / hydroxyl, groups ;</p> <p>hex / 6-membered, ring ;</p>	1 max	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT C, H and O molecules</p> <p>DO NOT CREDIT hexose</p> <p>ACCEPT pent ring</p> <p>IGNORE 6C ring</p> <p>IGNORE branched</p>
	(b) (iii)	<p>(saturated) lipids / fats / triglycerides ;</p> <p>protein / polypeptide ;</p>	2	<p>Mark the first two suggestions</p> <p>DO NOT CREDIT unsaturated (fats)</p> <p>IGNORE fatty acids / glycerol</p> <p>IGNORE amino acids / peptides</p>

Question		Answer	Marks	Guidance
	(iii)	<p><i>LDL</i></p> <p>L1 (carry cholesterol) from liver to, tissues / cells ;</p> <p>L2 receptors on (tissue) <u>cells</u> ;</p> <p>L3 raise / AW, <u>blood</u> cholesterol ;</p> <p>L4 increase / cause, deposition of, fats / lipids / triglycerides / cholesterol, <u>in</u> artery wall / under endothelium ;</p> <p>L5 form, plaques / atheromas ;</p> <p><i>HDL</i></p> <p>H1 (carry cholesterol) from, tissues / body / blood, to liver ;</p> <p>H2 receptors on, hepatocytes / liver <u>cells</u> ;</p> <p>H3 lower / reduce / decrease, (blood) cholesterol ;</p> <p>H4 reduce deposition, of fats / lipids / triglycerides / cholesterol ;</p> <p>H5 decrease, formation / risk, of, plaques / atheromas ;</p>	6 max	<p>If it is clear that candidates get LDL and HDL the wrong way round do not award L1 or H1 or QWC and then apply ECF</p> <p>L3 IGNORE deposits cholesterol</p> <p>L4 IGNORE LDL / fatty acids L4 ACCEPT under epithelium</p> <p>H1 ACCEPT back to liver</p> <p>H3 ACCEPT remove from blood</p> <p>H4 IGNORE LDL / fatty acids</p> <p>H5 IGNORE removing atheromas</p>
		QWC – Award if you award an L mark and an H mark with the same number twice	1	e.g. L1 and H1, and L3 and H3

Question		Answer	Marks	Guidance
	(c)	(i)	2	<p>ACCEPT ora throughout for consequences of non-red meat diet No ECF from 3 (b) (iii) ACCEPT animal fat is saturated fat</p> <p>CREDIT high LDL/HDL ratio IGNORE makes LDLs unqualified answer must imply increased amount</p>
		(ii)	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT type 1 diabetes IGNORE conary DO NOT CREDIT chronic</p>
			Total	15

Question			Expected Answers		Mark	Additional Guidance
3	(a)	(i)	D ; A ; F ;		3	Mark the first answer for each letter. If an additional answer is given then = 0 mark
	(a)	(ii)	B ; E ; F ; F ;		4	Mark the first answer for each letter If an additional answer is given then = 0 marks
	(b)		1 insoluble ; 2 does not , change / affect , water potential / Ψ , of cell ; 3 can be , broken down / hydrolysed / built up , quickly / easily ; 4 lots of branches for enzymes to attach ; 5 compact ; 6 (therefore) high energy content for mass / energy dense / AW ;	3 max	2 ACCEPT osmotically inactive / AW 3 Answers must contain the idea of ease or speed of breakdown IGNORE broken up Answers must imply density, e.g. 'it is compact and so stores a lot of energy' = 2 marks	

Question		Expected Answers	Mark	Additional Guidance
(c)	(i)	α /alpha , glucose ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT 'a'</p>
(c)	(ii)	<p>1 respiratory substrate / used for respiration ;</p> <p>2 source of / releases / provides, energy ;</p> <p>3 formation of ATP ;</p> <p>4 conversion into named compound ;</p>	1 max	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT any answer that clearly states that glucose is energy, makes energy, produces energy or creates energy</p> <p>1 ACCEPT used in respiration ACCEPT 'releases energy for respiration'</p> <p>2 IGNORE used for energy</p> <p>4 e.g. starch / cellulose / polysaccharide / disaccharide / glycogen / protein / lipid / sucrose / maltose / fructose / fat</p>
(c)	(iii)	D ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT F IGNORE triglyceride / fat / lipid / haemoglobin</p>

Question	Expected Answers	Mark	Additional Guidance																		
(d)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">glycogen</th> <th style="width: 50%; text-align: center;">cellulose</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><i>no hydrogen bonding</i></td> <td style="text-align: center;"><i>hydrogen bonding</i></td> </tr> <tr> <td>α / alpha , glucose</td> <td>β / beta , glucose</td> </tr> <tr> <td>1,4 <u>and</u> 1,6-glycosidic bonds or 1,6-glycosidic bonds present</td> <td>1,4-glycosidic bonds (only) or 1,6-glycosidic bonds not present</td> </tr> <tr> <td>branched</td> <td>not branched / linear / straight</td> </tr> <tr> <td>no , fibres / fibrils</td> <td>fibres / fibrils</td> </tr> <tr> <td>granules</td> <td>no granules</td> </tr> <tr> <td>all glucose units in same orientation</td> <td>adjacent glucose units in opposite orientation</td> </tr> </tbody> </table>	glycogen	cellulose	<i>no hydrogen bonding</i>	<i>hydrogen bonding</i>	α / alpha , glucose	β / beta , glucose	1,4 <u>and</u> 1,6-glycosidic bonds or 1,6-glycosidic bonds present	1,4-glycosidic bonds (only) or 1,6-glycosidic bonds not present	branched	not branched / linear / straight	no , fibres / fibrils	fibres / fibrils	granules	no granules	all glucose units in same orientation	adjacent glucose units in opposite orientation	3 max	<p>Comparative statements must be made on the same line Award 1 mark for each correct side by side comparison. ALLOW two valid comparisons in the same pair of boxes, e.g</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 2px;">α-glucose in a branched chain</td> <td style="width: 50%; padding: 2px;">β-glucose in a straight chain</td> </tr> </table> <p>= 2 marks</p> <p>ACCEPT 'a' and 'b'</p> <p>ACCEPT helical / spiral / coiled vs linear / straight DO NOT CREDIT α-helix</p>	α -glucose in a branched chain	β -glucose in a straight chain
glycogen	cellulose																				
<i>no hydrogen bonding</i>	<i>hydrogen bonding</i>																				
α / alpha , glucose	β / beta , glucose																				
1,4 <u>and</u> 1,6-glycosidic bonds or 1,6-glycosidic bonds present	1,4-glycosidic bonds (only) or 1,6-glycosidic bonds not present																				
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	Total	[16]																			

Question		Expected Answer	Mark	Additional Guidance
4	(a)	<p>1 <u>sequence / chain</u>, of amino acids ;</p> <p>2 (amino acids) joined by peptide bonds ;</p> <p><i>secondary</i></p> <p>S1 alpha / α, helix ;</p> <p>S2 <u>small regions of</u>, beta / β, pleated sheet / fold ;</p> <p>S3 hydrogen / H, bonds ;</p> <p><i>tertiary</i></p> <p>T1 secondary structure / helix / polypeptide chain, undergoes further, coiling / folding ;</p> <p>T2 <i>3 bonds / interactions from:</i> disulfide / ionic / hydrogen / hydrophobic or hydrophilic ;</p> <p>T3 hydrophilic <u>R groups</u> on outside (of molecule) / hydrophobic R groups on inside (of molecule) ;</p> <p><i>quaternary</i></p> <p>Q1 <u>4</u>, polypeptides / subunits ;</p> <p>Q2 2, alpha / α, chains and 2, beta / β, chains ;</p> <p>Q3 1 haem (group) per polypeptide / 4 haems (per molecule) ;</p> <p>3 prosthetic group (is) haem, (which) contains Fe^{2+} ;</p>	6 max	<p>CREDIT marking points from a clearly labelled diagram</p> <p>1 IGNORE polypeptide</p> <p>S3 Must be in context of secondary structure</p> <p>T1 ACCEPT polypeptide chain folds further</p> <p>T2 IGNORE if clearly in context of secondary or quaternary structures</p> <p>T2 H bond must be in context of tertiary structure</p> <p>'contains 2 α and 2 β polypeptides' = 2 marks (Q1 and Q2)</p> <p>Q3 IGNORE protein in ref to 1 haem (group) per polypeptide</p> <p>3 ACCEPT iron ion / Fe^+ / Fe^{3+}</p> <p>3 DO NOT CREDIT iron / Fe unqualified</p>
		QWC - correct refs to secondary, tertiary and quaternary structure ;	1	1 S mark and 1 T mark and 1 Q mark

Question		Expected Answer	Mark	Additional Guidance
	(b)	<p><i>(collagen has)</i></p> <p>1 amino acid, <u>chain</u> / <u>sequence</u> ;</p> <p>2 peptide bonds ;</p> <p>3 helical / helix ;</p> <p>4 <i>3 bonds / interactions from:</i> disulfide / ionic / hydrogen / hydrophobic or hydrophilic ;</p> <p>5 quaternary structure ;</p> <p>6 more than one polypeptide / subunit ;</p>		<p>Assume answer refers to collagen unless stated If the answer mentions only collagen, assume that the candidate thinks any features mentioned also apply to haemoglobin.</p> <p>1 IGNORE polypeptide 1 IGNORE repeating units</p> <p>3 DO NOT CREDIT if candidate refers to collagen having an α helix</p> <p>5 IGNORE primary /secondary / tertiary</p> <p>6 ACCEPT polypeptides but DO NOT CREDIT 3 polypeptides if number in haemoglobin not specified</p>
		Total	4 max 11	