Question			Answer	Marks	Guidance
1	(a)	(i)	N ;	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)	(iiii)	*name* peptide (bond / link) ; ***plus any two from ...*** *description of formation* between, amine group (of one amino acid) and carboxyl group (of another) ; H (from amine) combines with OH (from carboxyl) ; condensation (reaction) **OR** water, lost / eliminated / produced / created / AW ;	3 max	Maximum two marks for description. Name must be given to award 3 marks. **ACCEPT** marking points from diagram where amine and carboxyl groups are clearly labelled. **Mark writing first then look at diagram**. If diagram contradicts creditable text award maximum one mark for description. **DO NOT CREDIT** dipeptide **ACCEPT** phonetic spellings of amine and carboxyl **ACCEPT** 'carboxylic acid' and 'amino' **DO NOT CREDIT** amide / carbonyl

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

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

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

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

Question			Answer	Marks	Guidance
		(iii)		6 max	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**
			LDL		
			L1 (carry cholesterol) from liver to, tissues / cells **;**		
			L2 receptors on (tissue) cells **;**		
			L3 raise / AW, blood cholesterol **;**		**L3 IGNORE** deposits cholesterol
			L4 increase / cause, deposition of, fats / lipids / triglycerides / cholesterol, in artery wall / under endothelium **;**		**L4 IGNORE** LDL / fatty acids **L4 ACCEPT** under epithelium
			L5 form, plaques / atheromas **;**		
			HDL		
			H1 (carry cholesterol) from, tissues / body / blood, to liver **;**		**H1 ACCEPT** back to liver
			H2 receptors on, hepatocytes / liver cells **;**		
			H3 lower / reduce / decrease, (blood) cholesterol **;**		**H3 ACCEPT** remove from blood
			H4 reduce deposition, of fats / lipids / triglycerides / cholesterol **;**		**H4 IGNORE** LDL / fatty acids
			H5 decrease, formation / risk, of, plaques / atheromas **;**		**H5 IGNORE** removing atheromas
			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)	(red) meat contains (large amounts of) saturated, fat / fatty acids **;** (meat / saturated fat) associated with / leads to, increased / large amounts of, LDLs **;**	2	**ACCEPT** ora throughout for consequences of non-red meat diet No **ECF** from 3 (b) (iii) **ACCEPT** animal fat is saturated fat **CREDIT** high LDL/HDL ratio **IGNORE** makes LDLs unqualified answer must imply increased amount
		(ii)	(type 2) diabetes **;** angina / coronary heart disease / CHD / stroke / hypertension / high blood pressure / obesity **;**	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** **DO NOT CREDIT** type 1 diabetes **IGNORE** conary **DO NOT CREDIT** chronic
			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	**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** **ACCEPT** 'ɑ'
	(c)	(ii)	**1** respiratory substrate / used for respiration ; **2** source of / releases / provides, energy ; **3** formation of ATP ; **4** conversion into named compound ;	1 max	**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** **DO NOT CREDIT** any answer that clearly states that glucose **is** energy, **makes** energy, **produces** energy or **creates** energy **1** **ACCEPT** used in respiration **ACCEPT** 'releases energy for respiration' **2** **IGNORE** used for energy **4** e.g. starch / cellulose / polysaccharide / disaccharide / glycogen / protein / lipid / sucrose / maltose / fructose / fat
	(c)	(iii)	D ;	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** **ACCEPT** F **IGNORE** triglyceride / fat / lipid / haemoglobin

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>glycogen</th><th>cellulose</th><th></th></tr>
<tr><td>no hydrogen bonding</td><td>hydrogen bonding</td><td></td></tr>
<tr><td>α / alpha , glucose</td><td>β / beta , glucose</td><td>;</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><td>;</td></tr>
<tr><td>branched</td><td>not branched / linear / straight</td><td>;</td></tr>
<tr><td>no , fibres / fibrils</td><td>fibres / fibrils</td><td>;</td></tr>
<tr><td>granules</td><td>no granules</td><td>;</td></tr>
<tr><td>all glucose units in same orientation</td><td>adjacent glucose units in opposite orientation</td><td>;</td></tr>
</table>
</td><td>3 max</td><td>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

<table>
<tr><td>α-glucose in a branched chain</td><td>β-glucose in a straight chain</td></tr>
</table>
= 2 marks

ACCEPT ‘α’ and ‘b’

ACCEPT helical / spiral / coiled vs linear / straight
DO NOT CREDIT α-helix</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[16]</td><td></td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
4	(a)				**CREDIT** marking points from a clearly labelled diagram
		1	sequence / chain, of amino acids **;**		**1 IGNORE** polypeptide
		2	(amino acids) joined by peptide bonds **;**		
			secondary		
		S1	alpha / α, helix **;**		
		S2	small regions of, beta / β, pleated sheet / fold **;**		
		S3	hydrogen / H, bonds **;**		**S3** Must be in context of secondary structure
			tertiary		
		T1	secondary structure / helix / polypeptide chain, undergoes further, coiling / folding **;**		**T1 ACCEPT** polypeptide chain folds further
		T2	*3 bonds / interactions from:* disulfide / ionic / hydrogen / hydrophobic or hydrophilic **;**		**T2 IGNORE** if clearly in context of secondary or quaternary structures **T2** H bond must be in context of tertiary structure
		T3	hydrophilic R groups on outside (of molecule) / hydrophobic R groups on inside (of molecule) **;**		
			quaternary		
		Q1	4, polypeptides / subunits **;**		
		Q2	2, alpha / α, chains **and** 2, beta / β, chains **;**		'contains 2 α and 2 β polypeptides' = 2 marks (Q1 and Q2)
		Q3	1 haem (group) per polypeptide / 4 haems (per molecule) **;**		**Q3 IGNORE** protein in ref to 1 haem (group) per polypeptide
		3	prosthetic group (is) haem, (which) contains Fe^{2+} **;**		**3 ACCEPT** iron ion / Fe^{+} / Fe^{3+} **3 DO NOT CREDIT** iron / Fe unqualified
				6 max	
			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)				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.
			(collagen has)		
		1	amino acid, chain / sequence ;		**1 IGNORE** polypeptide **1 IGNORE** repeating units
		2	peptide bonds ;		
		3	helical / helix ;		**3 DO NOT CREDIT** if candidate refers to collagen having an α helix
		4	*3 bonds / interactions from:* disulfide / ionic / hydrogen / hydrophobic or hydrophilic ;		
		5	quaternary structure ;		**5 IGNORE** primary /secondary / tertiary
		6	more than one polypeptide / subunit ;		**6 ACCEPT** polypeptides but **DO NOT CREDIT** 3 polypeptides if number in haemoglobin not specified
				4 max	
			Total	**11**	