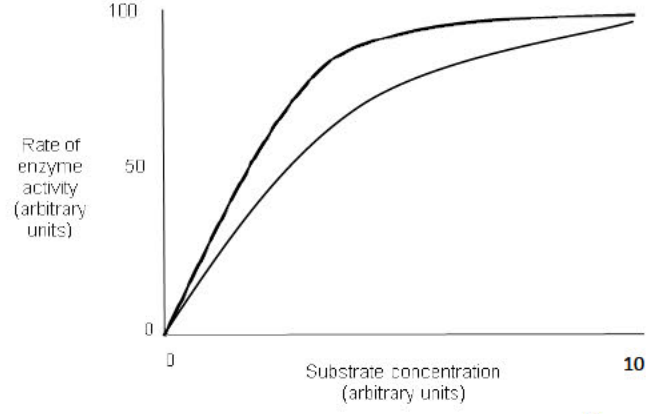
Question			Expected Answers	Mark	Additional Guidance
1	(a)	(i)	peptide (bond / link) **;**	1	**DO NOT CREDIT** dipeptide
	(a)	(ii)	hydrolysis **;** water / H_2O , is , added / used / needed **;**	 2	**IGNORE** name of bond **CREDIT** OH and H put back on amino acids **ACCEPT** (broken down) with water
	(b)		**1** substrate / protein , shape is (nearly) complementary to active site **; ora** **2** substrate / protein , enters / fits into , active site (on enzyme) **;** **3** induced fit / description of induced fit **;** **4** (forms) enzyme-substrate complex / ESC **;** **5** destabilising / straining / AW , of bonds (in substrate) **;** then (forms) enzyme-product complex **;** **6** product(s) / amino acids , leave (active site) **;**	 5 max	**1 ACCEPT** complimentary **1** "substrate binds to the active site which is complementary to the substrate shape" = 2 marks, mp1 and mp2 **2 ACCEPT** binds to / holds / bonds to **2 IGNORE** collides **5 IGNORE** breaks **6 IGNORE** EPC
	(c)	(i)	 no units for , 2nd column / egg white **;** amount (rather than volume / in 4th column) **;** incorrect unit / m , in final / time , column **;**	 3	**IGNORE** prompt, and mark the first three answers. **IGNORE** subsequent answers. **CREDIT** marks clearly annotated on table **ACCEPT** volume of egg white needs cm^3 **ACCEPT** 'they should have written volume' **ACCEPT** should have been s **IGNORE** should have been , sec / secs / seconds

Question			Expected Answers	Mark	Additional Guidance
	(c)	(ii)	equal volume in each tube ; add buffer / control pH ;	 1	**ACCEPT** "make sure the tubes have the same cm^3"
	(c)	(iii)	control ;	1	**DO NOT CREDIT** control variable
	(c)	(iv)	improve reliability ; assess, variability / spread of results ; allows calculation of mean ;	 2	**IGNORE** accurate **ACCEPT** identify , anomalous results / outliers **IGNORE** eliminate anomalous results **ACCEPT** reference to statistical test **ACCEPT** standard deviation / t-test / Mann-Whitney **CREDIT** improves accuracy of mean
	(d)	(i)	line drawn below line on graph ; line from origin that does not peak or plateau ;	 2	If the line goes above the original line at any point = 0 marks **ALLOW** lines touching at right hand end **DO NOT CREDIT** line with increasing gradient **ALLOW** plateau if it joins the original line **ALLOW** plateau below original line if it starts 4 small squares (or fewer) from the end  = 2 marks

Question			Expected Answers	Mark	Additional Guidance
	(d)	(ii)	similar shape to , substrate / (part of) albumin / protein **;** complementary (shape) to (part of) active site **;**	2	**IGNORE** same **ACCEPT** same shape as part of substrate **IGNORE** structure **ACCEPT** tertiary structure
			Total	**[19]**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>Statement</th><th>tri-glyceride</th><th>phospho-lipid</th><th>cholesterol</th></tr>
<tr><td>contains only the elements carbon, hydrogen and oxygen</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>insoluble in water</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>contains glycerol</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>contains ester bonds</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>important in membrane structure</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>contains fatty acids</td><td>✓</td><td>✓</td><td></td></tr>
</table>
;
;
;
;
;
;
</td><td>6</td><td>AWARD one mark per correct row
ACCEPT use of an unambiguous symbol other than a tick (e.g. Y)
DO NOT CREDIT if there is any ambiguity in the symbol used</td></tr>
<tr><td></td><td>(b)</td><td></td><td>mix with / add , ethanol / alcohol , and water ;

(goes) cloudy ;</td><td>2</td><td>DO NOT CREDIT reference to any incorrect biochemical test

ACCEPT milky / white (emulsion)
DO NOT CREDIT precipitate</td></tr>
<tr><td></td><td>(c)</td><td></td><td>less (overall , lipid / fat) ;

less / no , saturated (fat / lipid / fatty acids) ;

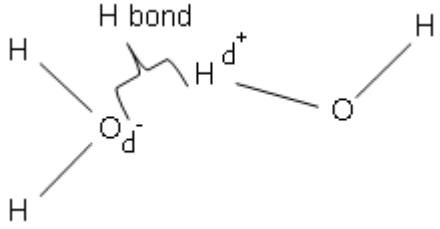
more unsaturated (fat / lipid / fatty acids) ;</td><td>2 max</td><td>Cannot be inferred from marking points 2 and 3
ACCEPT no / less , cholesterol
ACCEPT meat has more

ACCEPT meat has more

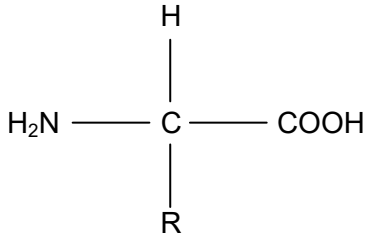
ACCEPT meat has less

“Higher ratio of unsaturated to saturated” = 2 marks (mp 2 and 3)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[10]</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
3	(a)	(i)	*primary* B **and** D **;**	1	**DO NOT CREDIT** if another letter is shown
		(ii)	*secondary* A **and** E **;**	1	**DO NOT CREDIT** if another letter is shown
		(iii)	*tertiary* F **and** G **;**	1	**DO NOT CREDIT** if another letter is shown
		(iv)	*quaternary* C**;**	1	**DO NOT CREDIT** if another letter is shown

Question			Answer	Mark	Guidance
	(b)	(i)	**1** between O and H (of adjacent molecules) **;** **2** between , electropositive / δ^+ / delta$^+$ (H), and , electronegative / δ^- / delta$^-$ (O) **;** **3** water molecule **,** is polar / has charge separation **;**	3	**1 DO NOT CREDIT** O/H molecules **2 ACCEPT** slightly , positive / negative **2 IGNORE** oxygen is negative / hydrogen is positive **2 DO NOT CREDIT** ions **AWARD** mp **1** and **2** for diagram below, i.e. H bond can be drawn as dotted or dashed or labelled, but **IGNORE** solid line **DO NOT AWARD** mark if diagram contradicts text  **3 ACCEPT** electrons pulled closer to oxygen atom / water is a dipole **3 IGNORE** electronegative / electropositive **3 IGNORE** oxygen is negative / hydrogen is positive **3 DO NOT CREDIT** ions

Question			Answer	Mark	Guidance
	(b)	(ii)	**1** medium for (metabolic) reactions **;** **2** (because) allows (named) ionic compound(s) to separate ; **3** transport **;** **4** **two** named transport , systems / media **OR** one example of a transport , medium / system , with a named example of what is transported ; **5** (organisms can) absorb / take in , (named) minerals / ions / (named) gas / food **;** **6** able to dilute toxic substances **;**	3 max	**1 ACCEPT** reactions can happen in water **1 ACCEPT** supports metabolic reactions **4 IGNORE** nutrients **5 ACCEPT** apoplast / sap / blood / symplast / vacuolar pathway / blood / lymph / xylem / phloem / tissue fluid / CSF **5 IGNORE** nutrients / substances **5 IGNORE** get / obtain **IGNORE** refs to osmosis
			Total	**10**	

Question			Answer	Marks	Guidance
4	(a)	(i)	<u>primary structure</u> ;	1	**ACCEPT** 1^{o} structure **IGNORE** polypeptide
	(a)	(ii)	NH_2 at one end ; COOH at opposite end ; C in centre (of a single amino acid) bonded (separately) to one R and one H ;	3	If R group not shown as '**R**' then award **max 2** (as general structure asked for in Q) **IGNORE** labels **ACCEPT** displayed structure of NH_2 / HNH **ACCEPT** displayed structure of COOH if correct double bond shown **AWARD** only if the candidate has drawn a single 'amino acid' molecule 
	(b)	(i)	strength / toughness / insolubility ;	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** strong / tough **IGNORE** flexible / inelastic **IGNORE** withstand pressure

Question			Answer		Marks	Guidance
	(b)	(ii)			6	One molecule of collagen is 3 polypeptide chains twisted around each other. **CREDIT** annotated diagrams unless contradicted by text
			1	peptide bonds , between amino acids / in polypeptide **;**		
			2	every 3rd amino acids is , same / glycine **;**		**2 ACCEPT** high proportion of / 35% , glycine / same amino acid
			3	coil / twist / spiral / helix **;**		**3 CREDIT** in context of single polypeptide or 3 polypeptides **but DO NOT CREDIT 'α**-helix' in the context of a single polypeptide **3 IGNORE** wound
			4	left-handed (helix) **;**		**4 'α**-helix, which is left handed' – **AWARD** mp4 but **DO NOT CREDIT** mp3
			5	glycine / small R group **,** allows closeness / twisting (of polypeptide chains) **;**		
			6	three polypeptide chains **;**		
			7	hydrogen / H , bonds between (polypeptide) chains **;**		**7** Must be in correct context **7 DO NOT CREDIT** H^+ / H_2 bonds
			8	no / few, hydrophilic (R) groups on outside (of molecule) **;**		
			9	(adjacent molecules joined by) crosslinks **;**		**9 ACCEPT** covalent bonds between adjacent molecules **9 DO NOT CREDIT** in context of bonding between 3 polypeptides **9 IGNORE** disulfide
			10	crosslinks / ends of molecules , being staggered **;**		
			11	<u>fibril</u> **;**		**11 IGNORE** micro

Question			Answer		Marks	Guidance
	(c)	(i)	transport / AW , of, oxygen / O_2 **;**		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** buffering blood / carrying CO_2 / storing oxygen **IGNORE** binding oxygen **IGNORE** Iron
	(c)	(ii)		*haemoglobin (has / is):*	3	**IGNORE** prompt lines – mark as prose but max 2 if an incorrect statement about haemoglobin is given **IGNORE** statements about collagen even if incorrect, answers must refer to haemoglobin
			1	globular **;**		**1 IGNORE** not fibrous / ball shaped
			2	hydrophobic (R) groups on inside / hydrophilic (R) groups on outsi **;**		
			3	4 **,** chains / sub-units / polypeptides **;**		**3 IGNORE** strands / molecules / proteins **4 ACCEPT** in haemoglobin the subunits are not all the same
			4	*idea that* subunits are (two) different types **;**		**3&4** "two alpha and two beta chains" = 2 marks (mp 3 and 4)
			5	α / alpha , helix **;**		**5 ACCEPT** a-helix
			6	*idea that* proportion of glycine similar to that , of other amino acids / in other proteins **;**		**6 ACCEPT** wide(r) range of amino acids **IGNORE** refs to Fe (as part of prosthetic group)
				Total	**15**	