

**2815/02 Biochemistry**

**January 2004**

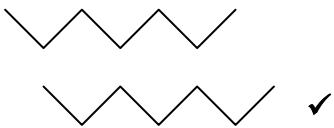
**Mark Scheme**

The following annotations may be used when marking:

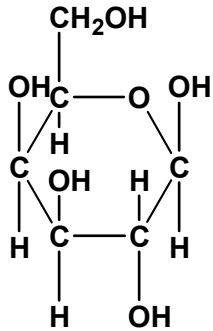
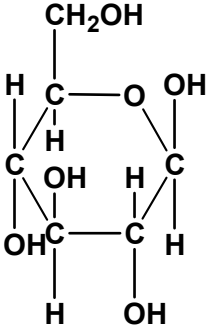
X	=	incorrect response (errors may also be underlined)
^	=	omission mark
bod	=	benefit of the doubt (where professional judgement has been used)
ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

Abbreviations, annotations and conventions used in the Mark Scheme:

/	=	alternative and acceptable answers for the same marking point
;	=	separates marking points
NOT	=	answers not worthy of credit
( )	=	words which are not essential to gain credit
<u>      </u> (underlining)	=	key words which <u>must</u> be used
ecf	=	allow error carried forward in consequential marking
AW	=	alternative wording
ora	=	or reverse argument

Question	Expected Answers	Marks
1(a)	Five✓	1
(b)(i)	Protease/peptidase✓. Accept any specific example, but not hydrolase.	1
(ii)	To remove/dissolve protein stains/deposits AW✓	1
(iii)	✓ for COOH and for both $-NH_3^+$	1
(c)(i)		1
(ii)	At least two <u>zigzag</u> chains. Atoms not needed. Hydrogen bond✓ between C=O and NH ✓. This could be done with a diagram.	2
	Question total	7
2	<p>Find 11 points from the following:</p> <ul style="list-style-type: none"> <li>• Denaturation involves enzyme losing its shape/tertiary structure/shape of active site✓.</li> <li>• by heat /high temperature✓ caused by thermal vibration/ breaking of weak attractions✓. AW</li> <li>• by marked pH changes ✓ alter charges on COOH and <math>NH_2</math> groups to/from <math>COO^-/NH_3^+</math> ✓✓(one for each group).</li> <li>• heavy metal <u>ions</u>/example ✓ interfere with van der Waals✓</li> <li>• Competitive inhibition involves an inhibitor with a similar shape ✓to the substrate binding reversibly/ to the active site in direct competition ✓. (The substrate cannot react so quickly.) An example ✓. Inhibition is overcome by increasing <math>[S]/V_{max}</math> unchanged✓. The last point could come from a graph.</li> <li>• Non-competitive inhibition involves the inhibitor binding reversibly at another site ✓ on the enzyme, altering its shape ✓ enough to make binding/catalysis difficult . An example could include metal <u>ions</u> such as <math>Hg^{2+}</math> or <math>Ag^+</math>✓ combining with free SH groups✓. Inhibition is not overcome by increasing <math>[S] / V_{max}</math> permanently lowered✓(or graph)✓.</li> </ul> <p>The QWC should be given for showing understanding of the ideas of denaturation, and competitive and non competitive inhibition.</p>	11
	Question Total	12

Question	Expected Answers	Marks
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3(a)(i)	<p>✓ for each structure.</p> <p>The name of glucose or galactose (must be with correct compound)✓.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>galactose</p> </div> <div style="text-align: center;">  <p>glucose</p> </div> </div> <p style="text-align: right;">(ignore <math>\alpha</math>)</p>	3
(ii)	$\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_6\text{H}_{12}\text{O}_6 \checkmark$ <p>Accept <math>2\text{C}_6\text{H}_{12}\text{O}_6</math> on the right.</p>	1
(b)	<p>An enzyme (lactase)✓AW</p> <p>(Hot aqueous hydrochloric) acid ✓</p>	2
(c)	<p>Hydrogen bonding ✓ between OH on alcohol groups and on water ✓. Accept diagram for second mark.</p>	2
(d)	<p>Energy is needed to break C-H/C-C bonds (in lactose)✓</p> <p>More energy is produced by formation of C=O/carbon-oxygen bonds( but not C-O) ✓ ( in carbon dioxide) / O-H bonds✓( in water).</p> <p>In carbohydrates more of these bonds are formed already/ carbohydrate is partly oxidised already✓ (therefore less exothermic overall).</p>	3
(e)	<p><math>\text{C}_3\text{H}_8\text{O}_3 \checkmark</math> and <math>\text{C}_{18}\text{H}_{34}\text{O}_2 \checkmark</math></p>	2
<b>Question Total</b>		<b>13</b>

Question	Expected Answers	Marks
4(a)(i)	$C_5H_{10}O_5$ ✓	1
(ii)	Accept vertical/horizontal version and do not expect correct stereochemistry at chiral centres. ✓ for CHO and ✓ for the rest. Must have 5 carbons.  OHCCH(OH)CH(OH)CH(OH)CH <sub>2</sub> OH	2
(iii)	Expect aldehyde ✓ and alcohol ✓, but mark their structure. Must be names not formulae.	2
(iv)	It lacks one oxygen on C2 . If they write hydroxyl group the position need not be specified. ✓	1
(b)	X phosphorus/P ✓    Y phosphorus/P ✓ Z nitrogen/N ✓	3
(c) (i)	cytosine ✓. Accept cytidine	1
(ii)	GCA ✓	1
(iii)	Hydrogen bonding ✓	1
(iv)	At least one different t-RNA needed for each of the 22 amino acids/ more than one used for some amino acids ✓AW	1
	Question Total	13
	PAPER TOTAL	45