2815/02 Biochemistry

June 2003

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
___ (underlining)	=	key words which <u>must</u> be used
ecf	=	allow error carried forward in consequential marking
AW	=	alternative wording
ora	=	or reverse argument

1 (a) (i) $C_5H_{10}O_5$ in any order✓ 1

(ii) The right hand OH would be below the plane of the ring AW ✓ 1
Accept C1 or first carbon.

(iii) OHC-CHOH-CHOH-CHOH-CH_2OH or vertically or similar ✓

Stereochemistry not needed 1

(iv) Alcohol ✓ Aldehyde/carbonyl ✓ Accept formulae for groups. 2
But the groups must correspond to C1 and C4 on <u>their</u> diagram in (iii).
Aldehyde and alcohol score if there is no diagram at all in (iii).

(b) Many ✓sites for hydrogen bonding✓.
Many may be implied by two or more in writing or on diagram. 3
O-H….OH_2 ✓

Question total 8

2 (a) (i) Basic sugar- phosphate-sugar-phosphate idea somehow ✓
With a clear drawing showing all five carbons on ribose the positions of the two links to phosphate earn ✓ each.
With a simple pentagon for the ribose the written 3',5'(or3,5) scores✓
But the simple pentagon alone cannot score position marks.
A tetrahydrofuran ring, lacking the fifth carbon, can score the 3' mark but not the 5'. 3

(ii) The sugar is deoxyribose in DNA ✓. Accept lacking an O but not deoxygenated. 1

(b) Look for seven marks from the following nine marking points:

- Triplets of bases ✓ in RNAs.
- The base pairs in RNA are CG✓ and AU✓ or names (no marks if using DNA). Names should be understandable and not clearly something else, eg alanine X.
- Complementary/matching triplets on mRNA and tRNA✓. Allow reference to codons and anticodons if clear that they are referring to triplets.
- Example of complementary triplets✓. If they have used T rather than U by mistake earlier do ecf here.
- Each tRNA carries its/appropriate/specific amino acid✓
- Idea of start/stop triplets/codons✓
- Base pairs are held together by hydrogen bonding ✓. 7
- Further detail either a diagram NH---N or NH---O or words to that effect.
  Or 3 H bonds in CG <u>and</u> 2 in AU. ✓

References to DNA and/or details of peptide synthesis do not answer the question.
QWC mark for correct use of t-RNA, m-RNA and complementary/matching base pairs (all three). 1

Question total 12

3 (a) (i)

$$\begin{array}{l} CH_2OCO(CH_2)_{16}CH_3 \\ | \\ CHOCO(CH_2)_{16}CH_3 \\ | \\ CH_2OCO(CH_2)_{16}CH_3 \end{array} + 3\,NaOH \rightarrow 3CH_3(CH_2)_{16}COONa \checkmark + \begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array} \checkmark$$

Balance ✓ (only with correct formulae)

Accept ionic/covalent versions of the sodium salt. 3

(ii) Moles of tristearin = 1000/890 = 1.12(4) ✓
Molar mass of soap = 306 $gmol^{-1}$ ✓
Mass of soap = 3 x 1.12(4) x 306 = 1032g ✓
Accept answers in range 1028 to 1032g. 3

If wrong in (i) they can score the moles of tristearin ✓ and then follow their Mr of soap and their balancing number from their (i) to give a method ✓:
Mass of soap = 1.12(4) x their balancing number x their Mr MAX 2/3

(b) Non-polar/(long)hydrocarbon chains✓ on tristearin.
Dissolve in hexane by Van der Waals attraction (not hydrophobic)✓.
Idea of instantaneous/fluctuating/temporary dipoles ✓.
AW 3

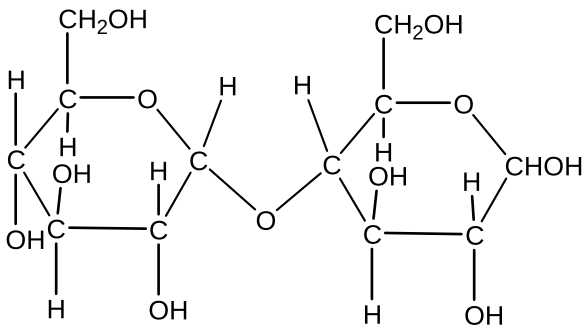
(c) In (biological) washing powder/fluid (accept detergent)✓ to remove/dissolve fat/grease (do not accept triglyceride)✓AW 2

(d) (i) Saturated formula would be $C_{21}H_{43}COOH$ ✓ AW but there must be a quantitative approach showing that there are 2 hydrogens too few for saturated. 1

(ii) Avoids using lubricants from fossil fuels/renewable/thermally stable at high temperature/biodegradable or similar sensible remark ✓ 1

Question total 13

4.(a)



First ✓ for a correct glycosidic link, <u>with the two hydrogens</u> unless they are using a skeletal formula.
Second ✓ for correct 1,4 position and orientation.
Skeletal and incomplete structures are acceptable as long as they have all twelve carbons and the oxygens in the rings and do not include a structural error other than incompleteness. [2]

(b) (i) Increasing proportion of molecules✓ have the activation energy ✓ AW
If no reference to Ea find 1 mark only for increasing number of collisions ✓.AW [2]

(ii) Bonds/weak attractions (any one type may be specified) in the protein are broken ✓
changing active site or tertiary structure/ enzyme denatured ✓ AW [2]

(c) (i) $H_2NCH(CH_3)COOH$ or fully displayed or zwitterion ✓ [1]

(ii) Any one C=O and any one NH (C=O … H-N) ✓
Accept two separate CONH. Accept any O and H in the backbone.
The answer must be on the printed diagram. [1]

(iii) C Hydrogen bonding ✓
$-CH_2OH$ … to any suitable group ✓

D Covalent / disulphide bridge ✓ (Do not accept disulphur or sulphide)
-S-S- ✓ (the S-S bond must be clearly a single covalent bond)

In each case there must be labelling/annotation or a few words to explain. [4]

Question total [12]

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