OCR

RECOGNISING ACHIEVEMENT

Subject: Methods of Analysis & Detection Code: 2815/04

Session : January Year : 2005

Mark Scheme

MAXIMUM MARK	45

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

   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

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Mark Scheme **Page 1 of**	**Unit Code** **2815/04**	**Session** **January**	**Year** **2005**	**Version** **1.03**
Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ____ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument			

Question	**Expected Answers**	**Marks**
1 (a) (i)	The presence of ^{13}C	**1**
(ii)	1.1% of all carbon is ^{13}C	**1**
	Ratio of M to M+1 peak allows us to calculate number of carbons present in molecule	**1**
(b)	^{37}Cl ^{81}Br	**1**
(c) (i)	Species present : $CH_2{}^{79}Br^{35}Cl^+$, $CH_2{}^{81}Br^{35}Cl^+$, $CH_2{}^{79}Br^{37}Cl^+$ $CH_2{}^{81}Br^{37}Cl^+$ (if no mass number shown assume ^{79}Br or ^{35}Cl)	**Any 3 correct 2** **Any 2 correct 1**
(ii)	Ratio ^{79}Br : ^{81}Br is 1 : 1 Ratio ^{35}Cl : ^{37}Cl is 3 : 1	
	Hence M : (M+2) : (M+4) is 3 : 4 : 1	**1**
(d)	(M-45) corresponds to a loss of C_2H_5O (or to $C_2H_5^+$)	**1**
	(M-43) corresponds to a loss of C_3H_7 (or to CH_2OH^+)	**1**
	Check logic carefully	
	A is $CH_3CH(OH)CH_2CH_3$ **B** is $CH_3CH_2CH_2CH_2OH$	**1**
		Total: 10

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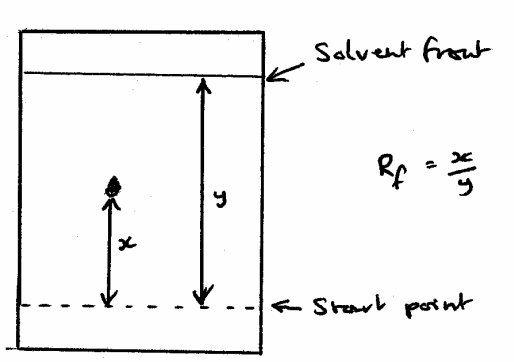
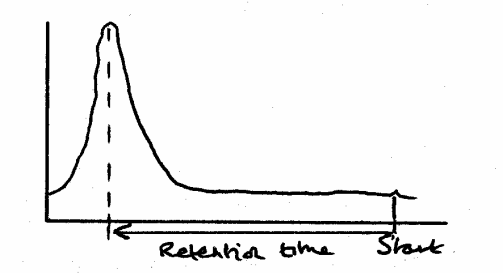
Question	**Expected Answers**			**Marks**

2 (a) (i)	Accept paper, column or thin-layer chromatography	**1**
(ii)	The R_f value	**1**
(iii)		**1**
(b) (i)	Retention time	**1**
(ii)	 (or mirror image)	**1**
(c) (i)	Partition	**1**
(ii)	Gas or liquid distributes itself between the mobile phase (carrier gas)	**1**
	and the stationary phase (hydrocarbon on silica)	**1**
	Different components are held more or less strongly on the stationary phase, separating them	**1**
	Some consideration of molecular size/volatility/bonding to stationary phase	**1** **Total: 10**

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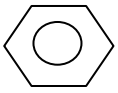
Question	Expected Answers	Marks
3 (a)	Electrons are excited to higher energy levels. When they drop back, energy is emitted as radiation	**1** **1**
(b)	Electrons occupy discrete energy levels / levels are quantised	**1**
(c)	Use of $E=hc/\lambda$	**1**
	$\frac{6.63 \times 10^{-34} \times 3.00 \times 10^{8}}{1.25 \times 10^{-7}} = 1.59 \times 10^{-18}$	**1**
(d) (i)	Chromophore	**1**
(ii)	$CH_3CH=CH_2$ CH_3CH_2OH and 	**3 x 1** **All 5 ringed=0** **4 ringed=1 max**
(e)	Vitamin A contains an extensive delocalised system / conjgraion. The energy levels in this are closer together than in compound **C** Energy is absorbed in the visible region in vitamin A rather than the uv region as in **C**	**1** **1** **1**
		Total: 12

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Question	Expected Answers	Marks
4 (a)	Use of correct logic e.g. use of M+1 to calculate carbons, deduction of oxygen from mass peak etc. No of carbons = $\frac{0.13 \times 100}{2.00 \times 1.1} = 5.9 \Rightarrow 6$ If $x = 6$ then $y = 116 - (6\times12 + 32) = 12$	**1** **Use of 1.1 => 1** **1** **[3]**
(b)	***Any 9 points, but must use data from the spectra.*** From ir spectrum peak at 1750 cm^{-1} suggests C=O and peaks at 1250 or 1180 cm^{-1} suggest C-O No –OH peak N.m.r. spectrum shows 4 proton environments Singlet at 3.6δ suggests $-CH_3$ next to an oxygen atom Triplet at 0.9δ suggests $-CH_3$ next to a carbon with 2Hs Triplet at 2.2δ suggests $-CH_2-$ next to $-CH_2-$ and an oxygen atom Complex peak at 1.5δ due to 4 protons suggests two similar $-CH_2-$ groups Mass spectrum shows loss of CH_3CH_2- at 87 and loss of CH_3O- at 85 Structural formula of **D** $CH_3CH_2CH_2CH_2CO_2CH_3$ QoWC – organising relevant information clearly and coherently, using specialist vocabulary when appropriate e,g. absorption, splitting pattern	**1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **[9 max]** **1** **Total: 13**