Mark Scheme Page 1 of 4	Unit Code 2815/04	Session June	Year 2004	Version 1.02

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)	The pigment is absorbing energy in the blue/green region / all but the red region of the visible spectrum	1
(b) (i)	• Energy is absorbed in promoting electrons from lower to higher orbitals. • Some energy in the visible range is absorbed. • The remainder of the light is reflected.	
(ii)	• The closer the energy levels the lower the energy absorbed • The red form has less delocalisation / conjugation / shorter chromophore (or converse) • This absorbs higher energy blue-violet region, (or converse) *Salvage only :Description of chromophore scores 1* *Different chromophores in A and B scores 1*	**5 max**
(c)	• Removal of electron represents ionisation • This is represented by the convergence limit of the spectrum / becomes continuous / highest frequency / shortest wavelength. • Wavelength/frequency of this limit is determined • Use E=hf to give the energy change per atom • Multiply by the Avagadro number for 1 mole of atoms	1 1 1 1 1
(d)	• Electrons have been given energy and promoted / excited • When they drop back to lower energy levels they emit red light (or equiv.)	1 1
		Total : 13

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Question	Expected Answers	Marks
2 (a)	The molecular ion peak is that produced by the molecule (i.e. unfragmented) / highest *m/e*	**1**
	The base peak is the largest peak in the spectrum / most common / most stable fragment	**1**
(b) (i)	^{13}C present in the molecule	**1**
(ii)	M : M+1 = 10.4 : 0.7 1.1% of sample is ^{13}C (somewhere)	**1**
	No. of carbon atoms = $\frac{0.7 \times 100}{10.4 \times 1.1}$ = 6.11 = 6 carbons	**1**
	If no working shown, only scores 1	
(c)	**(i)** 108	**1**
	(ii) $C_6H_5^+$ - no penalty for missed charge	**1**
(d)	**(i)** Bromine	**1**
	(ii) M_r = 187 – consequential on **(c)(i)** and **(d)(i)** if wrong halogen chosen	**1**
		Total : 9

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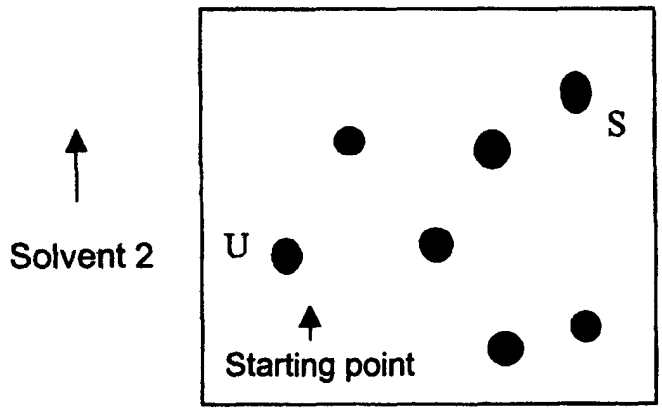
Question	Expected Answers	Marks

3 (a)	method stationary phase mobile phase glc coating / oil carrier gas paper water solvent TABLE Or better answers. **NOT** liquid for glc	**1 per row / column**
(b) (i) (ii)	 If both correctly ringed but not labelled allow 1 mark	**2 x 1**
(c)	**Any five of the following points** DNA split into fragments Using restriction enzymes Fragments separated by electrophoresis Heat treated to give single-strand DNA Labelled with ^{32}P / radioactive P or phosphate Immobilsed / stabilised Exposure of film to labelled fragments **QoWC** - correct sequencing	**Any 5 x 1** **1** **Total : 10**

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Question	Expected Answers	Marks
4 (a)	atomic emission – uv/visible n.m.r. – radio waves	**1** **1**
(b) (i)	Mass peak is at *m/e* 74 If there are two O atoms, the carbon and hydrogen atoms must add up to 42 mass units Since **D** is saturated x = 3 and y = 6 Hence **D** is $C_3H_6O_2$ (correct formula scores both)	**1** **1**
(ii)	**I** -OH at 2500-3500 cm^{-1} } Check spectra for **II** C=O at 1720 cm^{-1} } labels. Quoting from *Data sheet* not **III** –C-O at 1250 or 1050 cm^{-1} } permitted	**1** **1** **1**
(iii)	Proton at 11.7δ attached to oxygen (-COOH) 2 protons at 2.3 δ from a C–CH_2- group 3 protons at 1.2 δ from a C–CH_3 group (next to –C=O)	**1** **1** **1**
(iv)	Peak at 1.2 δ is next to a –CH_2- group / 2 equiv H Peak at 2.3 δ is next to -CH_3 group / 3 equiv H or better	**1** **1**
(v)	Hence **J** is $CH_3CH_2C(=O)OH$	**1** **Total : 13**