OCR

RECOGNISING ACHIEVEMENT

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

Session: June Year: 2002

Final Mark Scheme

MAXIMUM MARK	45

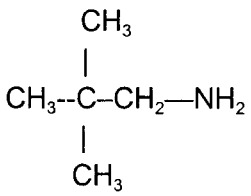
Mark Scheme Page 1 of	Unit Code 2815/4	Session June	Year 2002	Version 1

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)** Protein is heated / undergoes hydrolysis	(1)
	with hydrochloric acid / dilute acid NOT sulphuric or nitric acids	(1)
	for several hours	(1)
	(b) **(i)**	
	(ii) Q is neutral / at the isoelectric point	2 x (1)
	Q is a zwitterion / $H_3^+N - R - CO_2^-$	(1)
	(c) Allow **two** of the following	(1)
	Establishing relationships/paternity Forensic testing of biological samples Medicine - bone marrow matching Archaeology - matching organic fragments Testing for genetically modified foods etc	2 x (1)
	Total	**[9]**

Question	Expected Answers	Marks
2		
(a)	A_r = (206 x 0 2) + (207 x 0.2) + 208 x 0.6)	(1)
	= 207.4	(1)
	(allow ± for abundances)	
(b)	M:M+1 = 100. 1.1 x n	(1)
	Number of carbon atoms = $\frac{1.15 \times 100}{15 \times 1.1} = 7$	(1)
	J is $C_7H_6O_2$	(1)
(c)	30.0105 = CH_2O (12.0000 + (2 x 1.0078) + 15.9949)	(1)
	32.0261 = CH_3OH (12.0000 + 15.9949 + (4 x 1.0078))	(1)
	If two formulae are given with no working (1) only	
(d) (i)	Z is bromine	(1)
(ii)	**I** at 43 is $^+C_3H_7$ }	
	} charge (1) (need only be shown once)	(1)
	II at 124 is $C_3H_7{}^{81}Br^+$ }	(1)
		(1)
(iii)	**L** is $CH_3CHBrCH_3$ (accept 1- or 2-bromopropane)	(1)
	Total	**[12]**

Question	Expected Answers	Marks
3		
(a) (i)	Line + axes	2 x (1)
(ii)	Emission of 47 gives concentration of 48 mg cm^{-3} (conseq from graph) This is equivalent to 48 x 100 µg/100 cm^3 therefore 4.8×10^{-3} g of Na per 1g sample % Na = 0.48%	(1) (1)
(b) (i)	$\lambda = \frac{c}{f}$ therefore $f = c/\lambda$ $f = \frac{3 \times 10}{590 \times 10^{-9}} = 5.08 \times 10^{14}$ (or 5.08×10^{12})	(1)
(ii)	$\Delta E = \frac{hcL}{\lambda l}$ (or hfL) $= 203$ kJ mol^{-1} (or 2.03 kJ mol^{-1})	(1) (1)
(c) (i)	Promotion of electrons in molecular orbitals	(1)
(ii)	Any group containing 'n' or 'π' electrons e.g. C=C C-O C=O N-H etc	2 x (1)
(d) (i)	They contain different chromophores / different amounts of delocalisation / different energies	(1)
(ii)	Compound **M** It contains the shorter chromophore / lesser amount of delocalisation / or energy separation is greater	(1) (1)
	Total	(1) **[14]**

Question	Expected Answers	Marks
4		
(a)	**Mass** M:M+1 peaks show there are $\frac{0.23 \times 100}{4.10 \times 1.1}$ = 5 carbon atoms	(1)
	M_r = 87 means only one N atom	(1)
	Major peak is at 30 -> suggest $^+CH_2NH_2$	(1)
	i.r. Major absorption at >3000 cm^{-1} => N-H	(1)
	N.m.r. 3 proton environments	(1)
	Peak at 0 9 δ suggests $-CH_3$	(1)
	9 identical protons => 3 methyl groups	(1)
	Peak at 1 2 δ suggests a $-CH_2-$ group	(1)
	Peak at 2.4 δ suggests an $-NH_2$ group	(1)
	Lack of splitting confirms labile N-H	(1)
		Max 7
	Quality of written communication	(1)
(b)	Functional groups	
	$-NH_2$	(1)
	Q is 	(1)
	Total	**[10]**