

# **Chemistry**

Advanced GCE **2815/04**

Methods on Analysis and Detection QPEC

## **Mark Scheme for June 2010**

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Question	Expected Answers	Marks
1 (a)(i)	The M peaks would have different $m/e$ values / aspirin 180 and paracetamol 151 / aspirin 29 more / aspirin greater ✓	1
(ii)	$^{13}\text{C}$ ✓	1
(iii)	Uses equation $n = 100 (M + 1) \div 1.1 M$ and puts in values such that $8 = 100 (0.33) \div 1.1 M$ ✓  $M = 3.75/3.7/3.8$ ✓  Correct answer subsumes first mark	2
(b)(i)	128 ✓	1
(ii)	$(M + 2) = \text{CH}_2^{79}\text{Br}^{37}\text{Cl}(\text{g})^+$ ✓ and $\text{CH}_2^{81}\text{Br}^{35}\text{Cl}(\text{g})^+$ ✓  <i>State symbol and + charge are not essential</i>	2
(iii)	$\text{CH}_2^{81}\text{Br}^{37}\text{Cl}^+$ ✓	1
(c)	<b>A:</b> $\text{CH}_3\text{COCH}_3$ ✓ because peak at 15 due to $\text{CH}_3^+$ and peak at 43 due to $\text{CH}_3\text{CO}^+$ ✓  <b>B:</b> $\text{CH}_3\text{CH}_2\text{CHO}$ ✓ identify any 2 of 4 peaks at 29 $(\text{CH}_3\text{CH}_2)^+$ or $(\text{CHO})^+$ and 28 $(\text{CO})^+$ or $(\text{CH}_3\text{CH})^+$ 43 $(\text{CH}_2\text{CHO})^+$ 15 $(\text{CH}_3)^+$ ✓  <b>C:</b> $\text{CH}_2=\text{CHCH}_2\text{OH}$ ✓ Must use any two from: 14 $(\text{CH}_2)^+$ , 27 $(\text{CH}_2\text{CH})^+$ , 31 $(\text{CH}_2\text{OH})^+$ or 41 $(\text{CH}_2\text{CHCH}_2)^+$ ✓ Accept molecular formulae throughout (c) '+' not required throughout (c)	6
	<b>Total</b>	<b>14</b>

Question	Expected Answers	Marks
<b>2</b> (a)(i)	Distribution/solubility (solute) between (two) solvents ✓	<b>1</b>
(a)(ii)	(Glc) stationary = liquid; mobile = gas ✓  (paper) stationary = water (trapped in the cellulose/paper) and mobile phase = solvent ✓	<b>2</b>
(b)(i)	Spot directly above 'x' labelled as <b>D</b> ✓	<b>1</b>
(b)(ii)	4 ✓	<b>1</b>
(b)(iii)	Must show <b>four</b> different spots vertically above 'x' ✓ One spot stays at 'x' ✓	<b>2</b>
(c)	<b>7 marking points gives 6 max</b> <i>Principles</i> uses suitable solvent/gel ✓ potential difference/voltage ✓ and separation depends on mass/ size ✓ and by charge ✓ <i>Explanation</i> charge on amino acids changes with a change in pH/ suitable examples (including general structures) ✓ separation (speed of or direction) changes with change in pH ✓ hence pH is controlled by use of a buffer ✓	<b>6</b>
<b>QWC</b>	Two relevant sentences in context with at least two terms spelt correctly ✓	<b>1</b>
<b>Total</b>		<b>14</b>

Question	Expected Answers	Marks
3 (a)	Electrons fall back to lower levels ✓ and emit energy/radiation ✓  Accept light for radiation	2
(b)	Excited electrons fall back to different energy levels/series depends on which (of many) lower level it falls back to ✓	1
(c)	Energy levels get closer together/converge or the frequencies are closer together ✓	1
(d)	$f = 4.58 \times 10^{-19} / (6.63 \times 10^{-34}) = 7.32 \times 10^{14} \text{ (s}^{-1}\text{/Hz)} \checkmark$  uses $c = \lambda f$ to get $\lambda = 4.10 \times 10^{-7} \text{ (m)} \checkmark$ Correct answer worth 2 marks  converts to nm $\lambda = 410 \text{ (nm)} \checkmark$	3
	<b>Total</b>	<b>7</b>

Question	Expected Answers	Marks
4 (a)	<b>G</b> ✓ Because it has <b>no</b> absorption due to O–H/ in region 3230–3550 ( $\text{cm}^{-1}$ ) ✓	2
(b)(i)	Spectrum 4.2 is <b>G</b> (and 4.1 is <b>E</b> ) because in <b>G</b> $\text{CH}_3$ attached directly to ring is in region 2.3–2.7 ✓ $\text{CH}_3\text{--O}$ is in region 3.3–4.3 ✓ In <b>E</b> $\text{CH}_3$ s would be in region 0.7–1.6 ✓	3
(b)(ii)	If $\text{D}_2\text{O}$ added to <b>E</b> , ✓OH peak would disappear ✓ (if $\text{D}_2\text{O}$ added to <b>G</b> , no changes)	2
(c)	5/6 peaks ✓ Peak areas are 1 : 2 : 2 : 3 : 4/(2 : 2) ✓ 2 singlets, 2 triplets (ignore splitting of aromatic protons) ✓	3
	<b>Total</b>	<b>10</b>

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