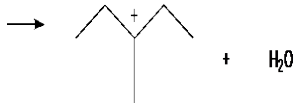


Mark Scheme

Question	Key	Marks	Guidance
1	D	1	
2	D	1	
3	C	1	
4	C	1	
5	B	1	
6	B	1	

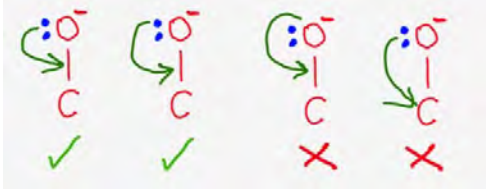
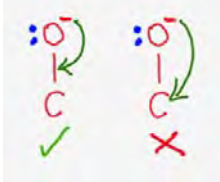

Mark Scheme

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	Movement of an electron pair ✓	1	AO1.1	For electron pair, ALLOW lone pair OR bonding pair OR 2 electrons
	(a)	(ii)	 <p>Correct carbon skeleton ✓</p> <p>'+' charge on correct carbon skeleton ✓</p>	2	AO3.1 ×2	ALLOW any combination of skeletal OR structural OR displayed formula as long as unambiguous IGNORE any other products
	(a)	(iii)	<p>Heterolytic one (bonded) atom/O receives both/2 electrons ✓</p> <p>Fission Breaking of a covalent bond OR breaking of C-O bond ✓</p>	2	AO1.2 AO1.1	<p>ALLOW 2 electrons go to one (bonded) atom/O</p> <p>IGNORE formation of ions/radicals</p> <p>For O atom, ALLOW species DO NOT ALLOW element OR molecule</p> <p>'Bond breaking' is not sufficient (no reference to covalent)</p>

Mark Scheme

Question	Answer	Marks	AO element	Guidance
(b) (i)	<p style="text-align: center;"> $\text{H}_3\text{C}-\text{C}(=\text{O})-\text{Cl} + \text{OH}^- \rightarrow \text{H}_3\text{C}-\text{C}(\text{OH})(\text{O}^-)-\text{Cl} \rightarrow \text{H}_3\text{C}-\text{C}(=\text{O})-\text{OH} + \text{Cl}^-$ </p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>✓ curly arrow to Cl AND Cl⁻ as product</p> </div>	4	AO3.2 ×4	<p>IGNORE any dipoles shown</p> <p>NOTE: curly arrows can be straight, snake-like, etc. but NOT double headed or half headed arrows</p> <p>Curly arrow from OH⁻ must</p> <ul style="list-style-type: none"> go to the C of C=O <p>AND</p> <ul style="list-style-type: none"> start from, OR be traced back to any point across width of lone pair on O of OH⁻ <ul style="list-style-type: none"> OR start from - charge OH⁻ ion <p>Curly arrow from C=O bond must start from, OR be traced back to, any part of C=O bond and go to O</p> <p>Curly arrow from O⁻ must</p>

Mark Scheme

Question		Answer	Marks	AO element	Guidance
					<ul style="list-style-type: none"> go to C=O bond <p>AND</p> <ul style="list-style-type: none"> start from, OR be traced back to, any point across width of lone pair  <ul style="list-style-type: none"> OR start from '−' charge of O[−]  <p>Curly arrow from C–Cl bond must start from, OR be traced back to, any part of C–Cl bond and go to Cl</p> 
(b)	(ii)	(OH [−]) donates an electron pair/lone pair OR (OH [−] acts as a) nucleophile ✓	1	AO1.2	
Total			10		

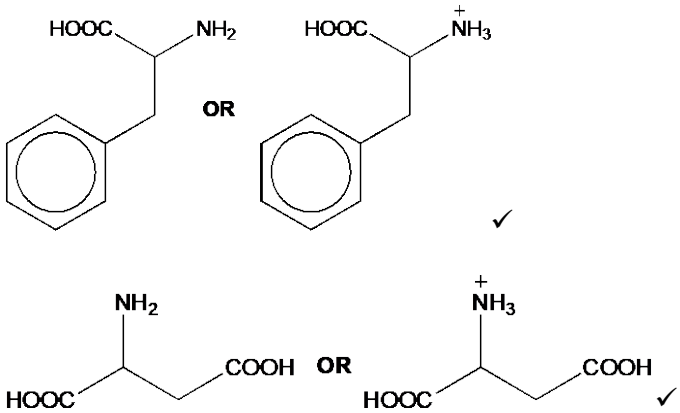
Mark Scheme

Question	Answer	Marks	AO element	Guidance
8	C	1	2.5	

Mark Scheme

Question		Answer	Marks	AO element	Guidance
9	(a)	<p> $\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_3\text{C}-\text{C}-\text{CH}_3 \\ \downarrow \text{NaBH}_4 \\ \boxed{\begin{array}{c} \text{OH} \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array}} \quad \checkmark \\ \downarrow \text{NaBr/Br}^- + \text{H}_2\text{SO}_4/\text{H}^+ \quad \checkmark \\ \begin{array}{c} \text{Br} \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array} \\ \downarrow \text{NH}_3 \text{ AND ethanol} \\ \text{OR excess NH}_3 \quad \checkmark \\ \boxed{\begin{array}{c} \text{NH}_2 \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array}} \quad \checkmark \\ \xrightarrow{\text{HCl} \quad \checkmark} \begin{array}{c} \text{NH}_3\text{Cl} \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \\ \text{salt H} \end{array} \end{array}$ </p>	5	2.5x5	<p>ALLOW any combination of skeletal OR structural OR displayed formula as long as unambiguous</p> <p>ALLOW HBr</p> <p>ALLOW for the bottom left structure</p>

Mark Scheme

Question	Answer	Marks	AO element	Guidance
(b) (i)	Ester Amide Amine Carboxylic acid 4 groups correct ✓✓✓ 3 groups correct ✓✓ 2 groups correct ✓	3	1.2×3	IGNORE amino acid ALLOW carboxyl IGNORE attempt to classify amide, e.g. secondary IGNORE formulae (question asks for names) IF > 4 functional groups are shown, <ul style="list-style-type: none"> Count 4 groups max but incorrect groups first IGNORE aryl OR alkyl group e.g. benzene, phenyl, aryl, arene, methyl
(ii)	Methanol 1 mark $\text{H}_3\text{C}-\text{OH}$ ✓ Amino Acids 3 marks  Both amino acids shown with NH_3^+ ✓	4	2.5×4	ALLOW any combination of skeletal OR structural OR displayed formula as long as unambiguous ALLOW + charge on H of NH_3 group, i.e. NH_3^+ If BOTH amino acids are shown with NH_3 groups (without the + charge) OR as NH_2^+ groups, award 2 of the 3 marks for the amino acids If BOTH amino acids are shown as correctly balanced salts, e.g. NH_3Cl , all marks can be awarded.

Mark Scheme

Question	Answer	Marks	AO element	Guidance
(iii)	<p>FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 22.4 OR 22 OR 23 award 3 marks</p> <p>$n(\text{aspartame})$ in 1 can = $0.167 / 294 = 5.68 \times 10^{-4}$ (mol) ✓</p> <p>$n(\text{aspartame})$ limit per day = $1.7 \times 10^{-4} \times 75 = 0.01275$ (mol) ✓</p> <p>number of cans = $0.01275 / 5.68 \times 10^{-4} = 22.4$ ✓</p>	3	2.2×3	<p>If there is an alternative answer, apply ECF and look for alternative methods</p> <p>Alternative methods</p> <p>$n(\text{aspartame})$ in 1 can = $0.167 / 294 = 5.68 \times 10^{-4}$ (mol) ✓</p> <p>$n(\text{aspartame})$ per kg = $5.68 \times 10^{-4} / 75 = 7.57 \times 10^{-6}$ (mol) ✓</p> <p>number of cans = $1.7 \times 10^{-4} / 7.57 \times 10^{-6} = 22.4$ ✓</p> <p>OR</p> <p>$n(\text{aspartame})$ limit per day = $1.7 \times 10^{-4} \times 75 = 0.01275$ (mol) ✓</p> <p>mass(aspartame) limit per day = $0.01275 \times 294 = 3.7485$ (g) ✓</p> <p>number of cans = $3.7485 / 0.167 = 22.4$ ✓</p>