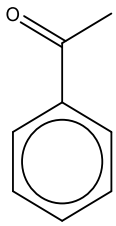
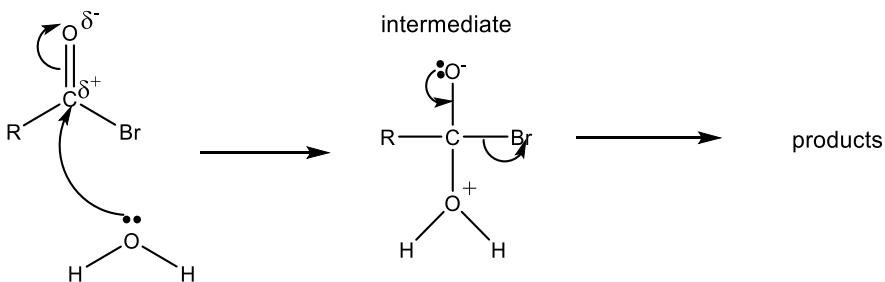
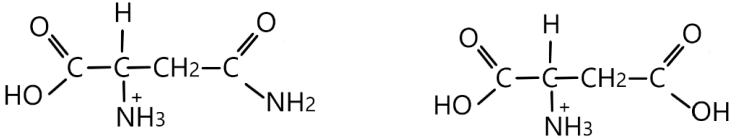
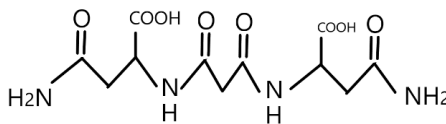
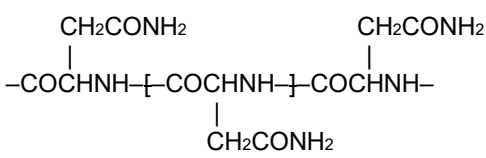


8(a)(i)	NO ₂ group directs to 3 (and 5) / meta position AND due to being an electron-withdrawing / electronegative group
8(a)(ii)	$\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{HSO}_4^- + \text{H}_2\text{O}$ OR $\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + 2\text{HSO}_4^- + \text{H}_3\text{O}^+$
8(b)(i)	
8(b)(ii)	M1: (reaction 1) ethanoyl chloride / CH ₃ COCl AND AlCl ₃ M2: (reaction 2) 2-bromopropane / (CH ₃) ₂ CHBr AND FeBr ₃
8(c)	M1: with C ₆ H ₅ Br no change / no precipitate AND with C ₆ H ₅ CH ₂ Br cream precipitate in C ₆ H ₅ Br M2: lone pair / p-orbital on Br delocalised / overlaps with ring / π system M3: C–Br bond stronger / has partially double bond character
8(d)(i)	(nucleophilic) addition–elimination
8(d)(ii)	 M1 M2: • lone pair on O • curly arrow from (lone pair) O (in H₂O) to C (of C=O) • correct dipole on C=O • curly arrow from the C=O bond to O atom any two [1], all four [2] M3: correct intermediate M4: curly arrow from (lone pair on) O(–) to C–O bond AND curly arrow from C–Br to Br

8(a)	the pH at which an amino acid exists as a zwitterion
8(b)	M1: [HOOCCH(NH ₃)CH ₂ CONH ₂] ⁺ M2: [HOOCCH(NH ₃)CH ₂ COOH] ⁺ 

8(c)	M1: $\text{HOCH}_2\text{CH}(\text{NH}_2)\text{CH}_2\text{CH}_2\text{NH}_2$ M2: $\text{HOCH}_2\text{CH}(\text{NH}_2)\text{CH}_2\text{CH}_2\text{OH}$ $\begin{array}{c} \text{H} \\ \\ \text{HOCH}_2 - \text{C} - \text{CH}_2 - \text{CH}_2\text{NH}_2 \\ \\ \text{NH}_2 \end{array}$ $\begin{array}{c} \text{H} \\ \\ \text{HOCH}_2 - \text{C} - \text{CH}_2 - \text{CH}_2\text{OH} \\ \\ \text{NH}_2 \end{array}$
8(d)(i)	$\text{HOOCCH}_2\text{COOH} + 2\text{SOCl}_2 \rightarrow \text{ClOCCCH}_2\text{COC}l + 2\text{SO}_2 + 2\text{HCl}$ [1]
8(d)(ii)	$\text{HOOCCH}(\text{CH}_2\text{CONH}_2)\text{NHCOCH}_2\text{CONHCH}(\text{CH}_2\text{CONH}_2)\text{COOH}$ M1: three molecules joined, with four correct amide groups only M2: whole structure correct as above, displayed formula accepted, skeletal formula as below accepted 
8(e)	M1: hydrolysis of amide to carboxylate ion M2: hydrolysis of $-\text{COOH}$ to carboxylate ion and rest of molecule $^-\text{OOCCH}(\text{NH}_2)\text{CH}_2\text{COO}^-$

8(f)	- three monomer residues - all linkages correct - correct trailing bonds - repeat unit marked contains correct atoms Any two [1], any three [2], all four [3] 
8(g)(i)	- rotate the plane of the plane polarised light - by the same angle - in opposite directions Any two [1], all three [2]
8(g)(ii)	racemic mixture