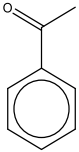
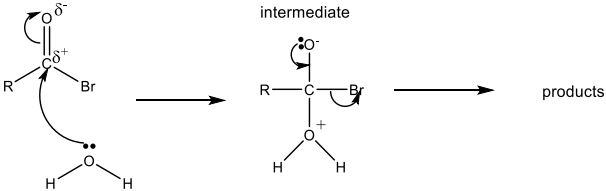
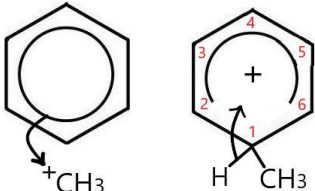
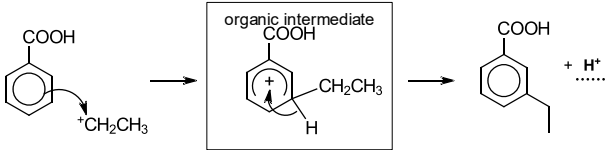


8(a)(i)	NO ₂ group directs to 3 (and 5) / meta position AND due to being an electron-withdrawing / electronegative group
8(a)(ii)	$\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{HSO}_4^- + \text{H}_2\text{O}$ OR $\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + 2\text{HSO}_4^- + \text{H}_3\text{O}^+$
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 H ₂ O) 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

9(a)	- all C atoms are sp² hybridised - bonds between C atoms are σ and π - C–C σ bonds are formed by overlap of sp² hybrid orbitals - C–C π bonds are formed by overlap of p orbitals - bonds between C and H atoms are σ - C–H bonds are formed by overlap of sp² hybrid orbitals and s orbitals Any two [1], any four [2], all six [3]
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9(b)	CH ₃ Cl and AlCl ₃
9(c)	 M1: curly arrow from within hexagon towards +C M2: intermediate, usual rules for horseshoe and + charge M3: curly arrow from C–H bond into ring AND H ⁺ product
9(d)	M1: HNO ₃ AND H ₂ SO ₄ M2: concentrated AND 25 °C ≤ T ≤ 60 °C
9(e)	alkaline KMnO ₄
9(f)	4-nitrobenzoic acid
9(g)	(hot) concentrated HCl and Sn
9(h)	M1: perform step 3 before step 2 OR perform step 2 before step 1 M2: COOH is 3-directing OR NO ₂ is 3-directing

5(a)	M1 and M2: any two [1], all three [2] (hexagonal ring) planar / (trigonal) planar 120° - sp² hybridised M3: p orbitals overlap sideways / laterally (with each other above and below the ring) forming π bonds M4: σ bonds form when sp ² / hybridised orbitals overlap end-on-end / head on
5(b)(i)	M1: (reaction 5) Pt / Ni + H ₂ (+ heat) M2: (reaction 6) (CH ₃) ₂ CHCOCl + AlCl ₃ (+ heat)
5(b)(ii)	reduction / hydrogenation
5(c)(i)	(CH ₂ CH ₃ group) directs to 2-, 4- (and 6-) positions AND due to being an electron donating group
5(c)(ii)	CH ₃ CH ₂ Br + FeBr ₃ → CH ₃ CH ₂ ⁺ + FeBr ₄ [–]
5(c)(iii)	 M1: curly arrow from inside / touching the hexagon to (CH ₂) group / C ⁺ charge M2: structure of the intermediate M3: curly arrow from C–H bond into / onto the ring AND formation / loss of H ⁺
5(c)(iv)	H ⁺ + FeBr ₄ [–] → HBr + FeBr ₃