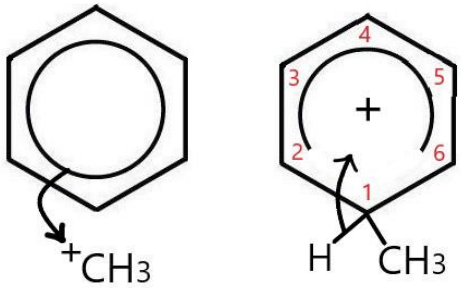
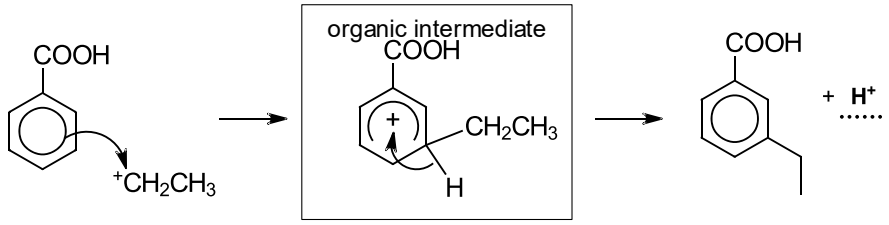
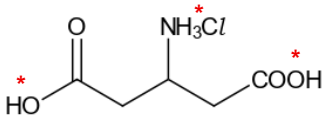
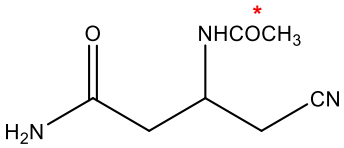
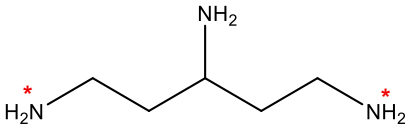
9(a)	• all C atoms are sp^2 hybridised • bonds between C atoms are σ and π • C–C σ bonds are formed by overlap of sp^2 hybrid orbitals • C–C π bonds are formed by overlap of p orbitals • bonds between C and H atoms are σ • C–H bonds are formed by overlap of sp^2 hybrid orbitals and s orbitals Any two [1], any four [2], all six [3]
9(b)	CH_3Cl 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_2SO_4 **M2:** concentrated **AND** 25 °C $\leqslant$ T $\leqslant$ 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° • sp^2 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) $(CH_3)_2CHCOCl$ + $AlCl_3$ (+ heat)
5(b)(ii)	reduction / hydrogenation
5(c)(i)	(CH_2CH_3 group) directs to 2-, 4- (and 6-) positions **AND** due to being an electron donating group
5(c)(ii)	CH_3CH_2Br + $FeBr_3$ → $CH_3CH_2^+$ + $FeBr_4^-$
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 + $FeBr_3$

6(a)	sp = 1 **AND** sp^2 = 1 **AND** sp^3 = 3
6(b)(i)	acid-base / neutralisation **AND** hydrolysis
6(b)(ii)	reaction 7  reaction 8  reaction 9  any two * [1], any three * [2], any five * [3], all six * [4]
6(c)(i)	five / 5
6(c)(ii)	<table><tr><td>proton environment</td><td>**a**</td><td>**b**</td><td>**c**</td></tr><tr><td>name of splitting pattern</td><td>doublet</td><td>multiplet</td><td>doublet</td></tr><tr><td>chemical shift range, δ / ppm</td><td>2.2–3.0</td><td>3.2–4.0</td><td>2.0–3.0</td></tr></table> any three [1], all six [2]