Solutions

Each answer shows the steps, then the **result**.

2.1

- an electron-pair acceptor / a species that is attracted to a region of high electron density

2.2

- electrophilic addition

3.1 B

- OH^- is a nucleophile and it replaces the bromine — nucleophilic substitution

3.2 C

- $:NH_3$ has a lone pair to donate — a nucleophile

3.3

(a)

- electrophilic substitution; electrophile

(b)

- (electrophilic) addition; electrophile

(c)

- hydrolysis (substitution); water/nucleophile

3.4

- benzene's delocalised π system is very stable; substitution keeps the stable ring intact, whereas addition would destroy the delocalisation, so substitution is favoured

3.5

(a)

- **I** electrophilic addition; **II** nucleophilic substitution; **III** elimination; **IV** oxidation

(b)

- The **electrophile** is bromine, Br_2, acting as $Br^{\delta+}$–$Br^{\delta-}$. The high electron density of the π bond repels the electrons in the approaching Br_2, inducing a dipole; the now $\delta+$ bromine atom is attacked by the π electrons

(c)

- The **solvent and conditions**: aqueous KOH favours substitution, giving the alcohol; hot KOH in ethanol favours elimination, giving the alkene

(d)

- Acidified potassium dichromate(VI), $K_2Cr_2O_7/H_2SO_4$; the solution turns from orange to green as $Cr_2O_7^{2-}$ is reduced to Cr^{3+}. Propanone is a **ketone** — its carbonyl carbon carries no hydrogen, so further oxidation would need a C–C bond to break, which this reagent cannot do