Halogenoalkanes Summary Map

AQA A-level Chemistry · 3.3.3 Halogenoalkanes

1 Names, classes, nucleophiles

3.3.1.1, 3.3.1.2, 3.3.3.1 i

- Halogen as a **prefix**: 2-bromobutane
- Carbons on C–X: **1° 2° 3°**
- **Nucleophile**: electron-pair donor
- Polar C–X: δ+ C attracts nucleophiles



2 Hydroxide and water

3.3.3.1 ii–iii

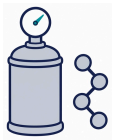
- **KOH(aq), warm**: alcohol
- Lone pair on O → δ+ C; C–X pair → X
- Water: weaker nucleophile, no charge
- $AgNO_3$ in ethanol: AgX precipitate

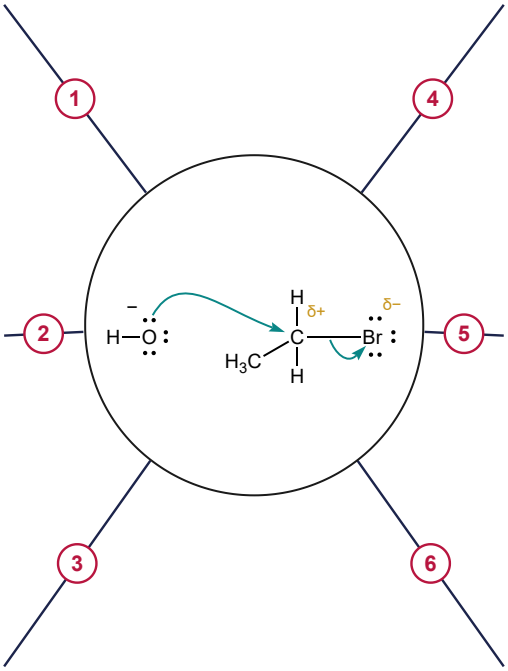


3 Ammonia and cyanide

3.3.3.1 ii–iii

- **Excess NH_3**, ethanol, sealed tube: amine
- Second NH_3 removes H^+
- **KCN in ethanol**, reflux: nitrile
- New C–C: chain one longer

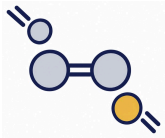




4 Elimination

3.3.3.2 i–iii

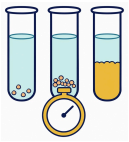
- **KOH in ethanol, hot**: alkene
- OH^- acts as a **base**: takes H^+
- Arrows: O lone pair → H; C–H → C=C
- Several alkenes: check E/Z



5 Rates of hydrolysis

3.3.3.1 iv

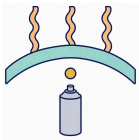
- Time to the precipitate: rate ∝ 1/t
- C–I weakest: **iodo fastest**
- Bond enthalpy, not polarity



6 Ozone and CFCs

3.3.3.3

- O_3 absorbs harmful **UV**
- UV breaks C–Cl in CFCs: **Cl•**
- $Cl• + O_3 \rightarrow ClO• + O_2$
- $ClO• + O_3 \rightarrow 2O_2 + Cl•$: a **catalyst**



One halogenoalkane, five products

bromoethane, CH_3CH_2Br; KOH aqueous for substitution, ethanolic for elimination

Reagent	Conditions	Product	OH^-, NH_3 or CN^- acts as
KOH(aq)	warm, reflux	ethanol	nucleophile
H_2O ($AgNO_3$)	ethanol, warm	ethanol + AgBr	nucleophile (water)
NH_3 (excess)	ethanol, sealed tube, heat	ethylamine	nucleophile, then base
KCN	ethanol, reflux	propanenitrile	nucleophile
KOH in ethanol	hot	ethene	base

Worked examples

Name and class

- $(CH_3)_3CBr$
- 2-bromo-2-methylpropane
- C–Br carbon has 3 C: **tertiary**

Three alkenes

- 2-bromobutane, hot ethanolic KOH
- but-1-ene
- **E** and **Z** but-2-ene

Which is faster?

- 1-iodo- or 1-chloropropane
- C–I 228, C–Cl 346 kJ mol^{-1}
- **iodo**: weaker bond

Halogenoalkanes link alkanes (3.3.2) and alkenes (3.3.4) to alcohols (3.3.5); amines and nitriles follow at A-level (3.3.11).

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