Amines Map

AQA A-level Chemistry · 3.3.11 Amines

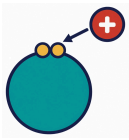
1 Preparing amines 3.3.11.1

- RX + excess NH_3: primary amine
- RCN reduced: longer chain
- $ArNO_2$ reduced: aromatic amine
- Aromatic amines make **dyes**



2 Bases 3.3.11.2

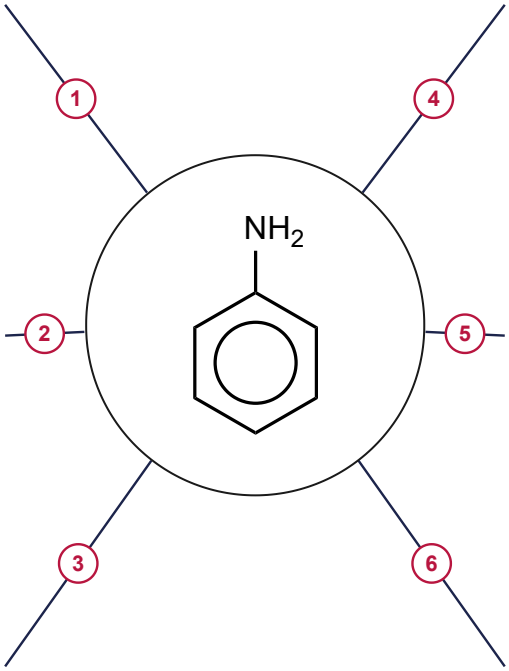
- N lone pair accepts H^+
- Weak bases
- **Butylamine > NH_3 > phenylamine**
- Alkyl pushes; ring delocalises



3 Substitution 3.3.11.3

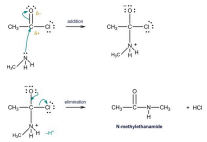
- Lone pair attacks δ+ carbon
- Primary, secondary, tertiary
- Then R_4N^+ salt
- A base removes H^+





4 Addition-elimination 3.3.11.3

- Lone pair adds to C=O
- π-pair moves to O
- C=O re-forms, Cl^- leaves
- N-substituted amide



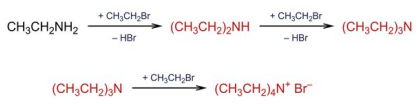
5 Acid anhydrides 3.3.11.3

- Same mechanism, slower
- By-product: carboxylic acid
- Cheaper, less corrosive
- Ammonia gives a primary amide



6 Surfactants 3.3.11.3

- R_4N^+ with one long chain
- Cationic: **positive head**
- Fabric softeners
- Hair conditioners



Reactions of amines ammonia and primary amines

Reagent	Product	Mechanism
Water	$RNH_3^+ + OH^-$	Proton transfer
RX	Secondary amine + HBr	Nucleophilic substitution
Excess RX	Quaternary ammonium salt	Nucleophilic substitution
RCOCl	N-substituted amide + HCl	Addition-elimination
$(RCO)_2O$	N-substituted amide + RCOOH	Addition-elimination

Worked examples

Yield

- 12.3 g $C_6H_5NO_2$: 0.100 mol
- 7.44 g product: 0.0800 mol
- **80%**

Atom economy

- $(CH_3CO)_2O + NH_3$
- 59 ÷ 119 × 100
- **49.6%**

Chain length

- Target butylamine
- From 1-bromopropane
- **KCN, then reduce**

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