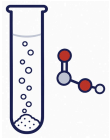
Carboxylic Acids and Derivatives Summary Map

AQA A-level Chemistry · 3.3.9 Carboxylic acids and derivatives

1 Carboxylic acids 3.3.9.1

- –COOH, names **-oic acid**
- **Weak** acids: partly dissociated
- Carbonates: **CO_2**, fizzing
- Metals: H_2; bases: salt + water



2 Esterification 3.3.9.1

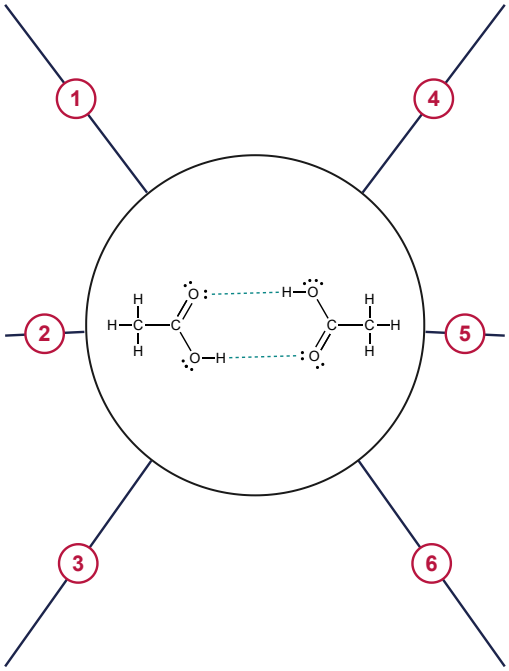
- Acid + alcohol ⇌ ester + water
- **Conc. H_2SO_4** catalyst, warm
- Name: **alkyl alkanoate**
- Solvents, plasticisers, perfumes



3 Ester hydrolysis 3.3.9.1

- Dilute acid, reflux: **reversible**
- NaOH(aq), reflux: **complete**
- Gives the carboxylate + alcohol
- Add acid to free the RCOOH





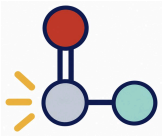
4 Fats, soap, biodiesel 3.3.9.1

- Fats: **triesters** of glycerol
- + 3NaOH → glycerol + **soap**
- + $3CH_3OH$, catalyst → **biodiesel**
- Biodiesel: methyl esters



5 Acyl chlorides 3.3.9.2

- –COCl, **-oyl chloride**: very δ+ C
- Water → acid; alcohol → ester
- NH_3 → amide; amine → N-substituted amide
- **Addition-elimination**, HCl fumes



6 Anhydrides and aspirin 3.3.9.2

- $(CH_3CO)_2O$: same products
- By-product **CH_3COOH**, not HCl
- Aspirin: the phenol OH acylated
- Cheaper, safer, less corrosive



Reagents and products

room temperature unless a condition is given

Starting compound	Reagent and conditions	Organic product
ethanoic acid	$NaHCO_3$(aq)	sodium ethanoate (+ CO_2)
ethanoic acid	C_2H_5OH, conc. H_2SO_4, warm	ethyl ethanoate
ethyl ethanoate	NaOH(aq), heat under reflux	sodium ethanoate + ethanol
ethanoyl chloride	CH_3NH_2	N-methylethanamide
ethanoic anhydride	CH_3OH	methyl ethanoate + CH_3COOH
a vegetable oil	CH_3OH, KOH catalyst	methyl esters (biodiesel)

Worked examples

Name the ester

- $CH_3CH_2COOCH_3$
- alcohol part: methyl
- **methyl propanoate**

Two equivalents

- CH_3COCl + $2NH_3$
- → CH_3CONH_2
- **+ NH_4Cl**

Soap from a fat

- $(RCOO)_3C_3H_5$ + 3NaOH
- → 3RCOONa
- **+ glycerol**

Acids and esters are identified by NMR in 3.3.15; polyesters and polyamides follow in 3.3.12.

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