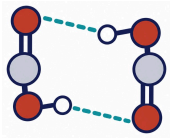
Carboxylic Acids and Esters Summary Map

Cambridge International AS & A Level Chemistry · Topic 18 Carboxylic acids and derivatives

1 Carboxylic acids 18.1

- –COOH, names **-oic acid**
- **Dimers**: two hydrogen bonds
- Boil above alcohols of similar M_r
- Short chains mix with water



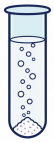
2 Making acids 18.1.1

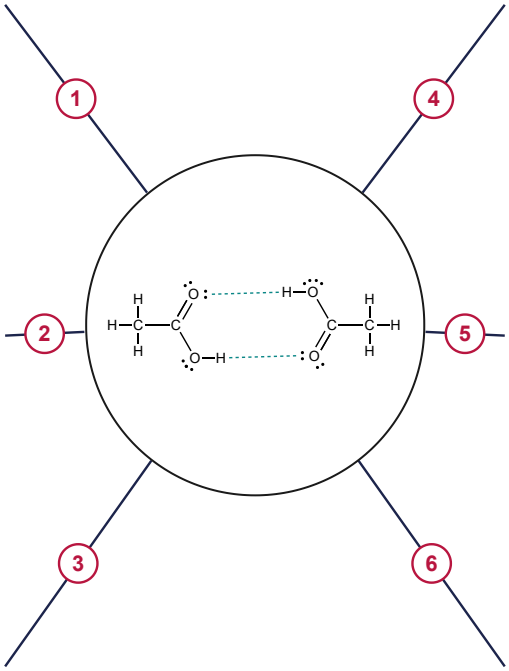
- 1° alcohol or aldehyde + [O]
- $K_2Cr_2O_7$ or $KMnO_4$ / H^+, **reflux**
- Nitrile + dilute acid, reflux
- Or dilute alkali, then **acidify**



3 Acids as acids 18.1.2

- Reactive metal: salt + **H_2**
- Alkali: salt + water
- Carbonate: salt + water + **CO_2**
- Weak: partly dissociated





4 Reduction 18.1.2

- **$LiAlH_4$** in dry ether, [H]
- Acid → **primary** alcohol
- $RCOOH + 4[H] \rightarrow RCH_2OH + H_2O$
- All the way: no aldehyde left



5 Making esters 18.2.1

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



6 Hydrolysing esters 18.2.2

- Dilute acid, reflux: **reversible**
- Dilute NaOH, reflux: **complete**
- Alkali gives salt + alcohol
- Acidify to free the acid



Reagents and products from ethanoic acid

room temperature unless a condition is given

Starting compound	Reagent and conditions	Organic product
ethanoic acid	Mg	magnesium ethanoate (+ H_2)
ethanoic acid	$NaHCO_3$(aq)	sodium ethanoate (+ CO_2)
ethanoic acid	C_2H_5OH, conc. H_2SO_4, warm	ethyl ethanoate
ethanoic acid	$LiAlH_4$ in dry ether	ethanol
ethanenitrile	dilute HCl, heat under reflux	ethanoic acid
ethyl ethanoate	NaOH(aq), heat under reflux	sodium ethanoate + ethanol

Worked examples

Name the ester

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

Add a carbon

- 1-bromopropane
- KCN, then dilute HCl
- **butanoic acid**

Get the acid

- ester + NaOH(aq)
- salt + alcohol
- add HCl: **the acid**

Acyl chlorides, acidity and further oxidation follow in Topic 33; spectra identify acids and esters in Topics 22 and 37.

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