Acyl Chlorides and Acidity Summary Map

Cambridge International AS & A Level Chemistry · Topic 33 Carboxylic acids and derivatives

1 Making acyl chlorides

33.1.2, 33.3.1

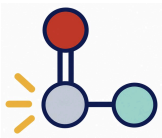
- **PCl_5**: $POCl_3$ + HCl
- **PCl_3** + heat: H_3PO_3
- **$SOCl_2$**: SO_2 + HCl (gases)
- Names end **-oyl chloride**



2 Reactions

33.2.1, 33.3.2

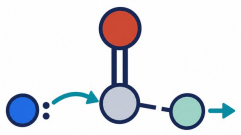
- Water: **acid** + HCl
- Alcohol or phenol: **ester** + HCl
- NH_3 or amine: **amide**
- Room temperature, fast

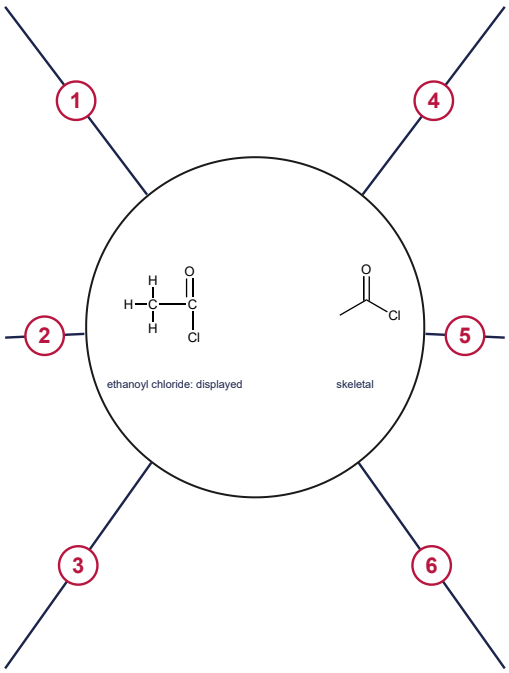


3 Addition-elimination

33.3.3

- Lone pair attacks **δ+ C**
- π pair moves to O
- C=O re-forms, **Cl^-** leaves
- Cl^- takes H^+: HCl

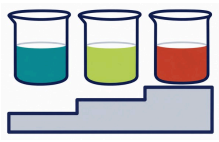




4 Acids, phenols, alcohols

33.1.4

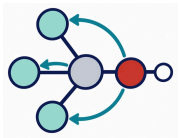
- $RCOO^-$: charge over **two O**
- $C_6H_5O^-$: into the **ring**
- RO^-: on one O
- Acid > phenol > alcohol



5 Chloro acids

33.1.5

- Cl **withdraws** electrons
- Anion more stable
- More Cl: **stronger**
- Nearer the COOH: stronger



6 Oxidation and hydrolysis

33.1.3, 33.3.4

- HCOOH, $(COOH)_2$ → **CO_2**
- Acyl chloride: **fast**
- Alkyl chloride: slow
- Aryl chloride: **none**



Reagents and products from ethanoyl chloride

all at room temperature

Reagent	Organic product	Other product	Type of product
water	ethanoic acid	HCl	carboxylic acid
ethanol	ethyl ethanoate	HCl	ester
phenol	phenyl ethanoate	HCl	ester
ammonia (2 mol)	ethanamide	NH_4Cl	amide
methylamine (2 mol)	N-methylethanamide	$CH_3NH_3^+Cl^-$	substituted amide
dimethylamine (2 mol)	N,N-dimethylethanamide	$(CH_3)_2NH_2^+Cl^-$	substituted amide

Worked examples

Phenyl benzoate

- C_6H_5COCl + C_6H_5OH
- room temperature
- **$C_6H_5COOC_6H_5$ + HCl**

Strongest acid?

- CH_3COOH, $ClCH_2COOH$
- Cl_3CCOOH
- **Cl_3CCOOH**: three Cl

$AgNO_3$ test

- acyl Cl: white at once
- alkyl Cl: white, slowly
- **aryl Cl: none**

Amides return in Topic 34; acyl chlorides are key steps in planning a synthesis in Topic 36.

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