CHEMISTRY ONLINE
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CHEMISTRY

ORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	CARBOXYLIC ACIDS
PAPER TYPE:	SOLUTION - 2
TOTAL QUESTIONS	10
TOTAL MARKS	20

Carboxylic Acids and Derivatives - 2

1.

Samples of 1-chloropropane and ethanoyl chloride can be distinguished by the addition of an aqueous solution of silver nitrate.

Observation with 1-chloropropane:

- No visible change.
  Or
- "small amount of precipitate" or "precipitate forms slowly."

Observation with ethanoyl chloride:

- White precipitate.
  Or
- "large amount of precipitate" or "precipitate forms immediately."

(2)

2. **A**

(1)

3.

(a)

Equation for reaction alcohol and acid anhydride:

$(CH_3)_2CHOH + (CH_3CO)_2O \rightarrow CH_3COOCH(CH_3)_2 + CH_3COOH$

IUPAC name of the ester ($CH_3COOCH(CH_3)_2$):

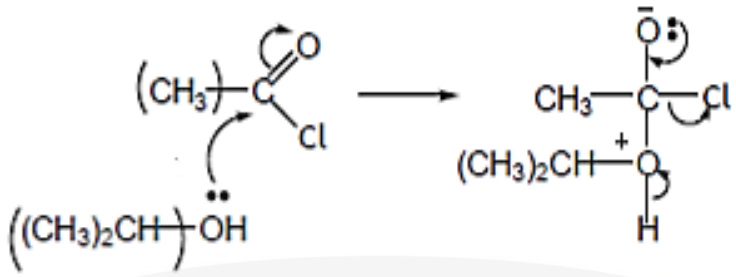
Propan-2-yl ethanoate

(2)

(b)

An ester can be prepared by reacting $(CH_3)_2CHOH$ with CH_3COCl as following mechanism.

Mechanism:



Product:

$CH_3COOCH(CH_3)_2$

(4)

4. B

(1)

5.

Name the type of reaction:

Hydrolysis or addition-elimination.

Explanation with Reactions:

Polyesters contain ester functional groups in their polymer chains. When aqueous sodium hydroxide (NaOH) is introduced, the ester bonds undergo hydrolysis.

- *In the ester linkage of the polyester, the carbonyl carbon (C=O) is partially positively charged (δ+), making it susceptible to nucleophilic attack.*
- *The nucleophilic hydroxide ion (OH^-) attacks the electrophilic (δ+) carbonyl carbon in the ester linkage.*
- *This nucleophilic attack leads to the breaking of the ester bond and the formation of a carboxylate ion and an alcohol, resulting in the degradation of the polyester material.*

Hydrolysis Reaction:

The ester bond in the polyester reacts with hydroxide ions (OH^-) from the sodium hydroxide solution.

Nucleophilic attack by hydroxide ion on the carbonyl carbon of the ester group:

$R\text{-}COO\text{-}R' + OH^- \rightarrow R\text{-}COO^- + R'\text{-}OH$

The hydroxide ion (OH^-) acts as a nucleophile and attacks the electrophilic ($\delta+$) carbonyl carbon in the ester linkage of the polyester, breaking the ester bond.

(3)

6. D

(1)

7.

Name:

Propyl methanoate

Equation:

$HCOOC_3H_7 + NaOH \rightarrow HCOONa + C_3H_7OH$

$HCOOC_3H_7 + OH^- \rightarrow HCOO^- + C_3H_7OH$

(2)

8. B

(1)

9.

Test with Silver Nitrate Solution:

Add Silver Nitrate Solution ($AgNO_3$):

Mix the suspected aldehyde with silver nitrate solution ($AgNO_3$).

Observation:

If the aldehyde is contaminated with traces of unreacted acyl chloride, it will react with silver nitrate to form a white precipitate of silver chloride ($AgCl$).

So, formation of a white precipitate indicates the presence of silver chloride, suggesting contamination with unreacted acyl chloride.

(2)

10. C

(1)

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