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TOPIC 10.5: CARBOXYLIC ACIDS

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CHAPTER ANALYSIS



• Key component of Organic Chemistry

• Know how to draw your –COOH functional group

- Heavy overall weightage
 - Entire Organic Chemistry portion accounts for 15-20% of each year's Chemistry paper



KEY CONCEPT

CARBOXYLIC ACIDS HOMOLOGOUS SERIES FUNCTIONAL GROUP GENERAL FORMULA





CARBOXYLIC ACIDS

Carboxylic acids have a general formula: **C**_n**H**_{2n+1}**COOH**.

Functional group

Carboxylic acids contain the **-COOH functional group** (carboxyl group).

KEY CONCEPT

CARBOXYLIC ACIDS PHYSICAL PROPERTIES PRODUCTION OF ETHANOIC ACID ESTERIFICATION



PHYSICAL PROPERTIES

Physical property	Reasoning
	As the number of carbon atoms in the carboxylic acids increases, the melting and boiling points of carboxylic acids increases as well.
Melting and boiling points	As the number of carbon atoms in a carboxylic acid increases , the size of the molecules are bigger and have stronger intermolecular forces of attraction between each other. As such, more heat energy is needed to overcome the intermolecular forces of attraction between the carboxylic acid molecules. Hence, larger carboxylic acid containing more carbon atoms will have higher melting and boiling points.
Volatility	As the number of carbon atoms in the carboxylic acid increases , the volatility of carboxylic acid decreases . (similar to m.p. & b.p.)
	With a higher relative molecular mass, there would be stronger intermolecular forces of attraction between the carboxylic acid molecules. As such, more heat energy is needed to overcome the intermolecular forces of attraction between the carboxylic acid molecules.
Density	As the number of carbon atoms in the carboxylic acid increases, the density of carboxylic acid increases.
Viscosity	As the number of carbon atoms in the carboxylic acid increases, the viscosity of carboxylic acid decreases.(more difficult to flow)Carboxylic acids with longer hydrocarbon chains flow less easily as they tend to get stuck together.
Flammability	As the number of carbon atoms in the carboxylic acid increases, the flammability of alcohols decreases. (more difficult to burn)
Solubility	Carboxylic acids are soluble in water , but as the number of carbon atoms increases, solubility in water decreases.

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MAKING ETHANOIC ACID

PRODUCTION OF ETHANOIC ACID

1) Oxidation of alcohol

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PRODUCTION OF CARBOXYLIC ACID

1) Oxidation of alcohol

Ethanol C_2H_5OH can be converted to ethanoic acid C_2H_5COOH using oxidising agents.

C_2H_5OH (aq) + O_2 (g) → CH_3COOH (aq) + H_2O (l)







WEAK ACID

Carboxylic acids are **weak acids** as they only **partially dissociate in water** to release a low concentration of H⁺ ions.

 $CH_3COOH (aq) \rightleftharpoons CH_3COO^- (aq) + H^+ (aq)$

NAME OF SALT FORMED

Carboxylic acids are weak acids and will be able to react with reactive metals, bases and carbonates.

The name of the salt formed would be based on the carboxylic acid that is used and ends with '-ate'.

Reaction	Products formed
Potassium hydroxide + propanoic acid	Potassium propano <u>ate</u> + water
(base + acid)	(salt + water)
Calcium Carbonate + pentanoic acid (carbonate + acid)	Calcium pentano <u>ate</u> + carbon dioxide gas $(salt + CO_2)$
Magnesium + ethanoic acid	Magnesium ethano <u>ate</u> + hydrogen gas
(metal + acid)	(salt + hydrogen gas)





Dec- 10

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