

The Importance of Functional Groups and Isomerism in Organic Molecules

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Introduction

Throughout this report, there will be a list of functional groups for six chosen compounds which are ethanol, propanone, ethyl ethanoate, prop ene, 4-aminobenzenecarboxylic acid and 4-methylbenzenecarboxylic acid. The displayed formulae will be shown for each of these compounds and how usage of these compounds related to the way they are structured. Also the chosen compounds will be linked to particular isomers and their industrial and commercial importance.

Ethanol

The molecular formula for ethanol: $\text{CH}_3\text{CH}_2\text{OH}$

The functional group of ethanol: Alcohol, this is because ethanol has a hydroxyl group -OH, which indicates it is an alcohol.

The displayed formulae for ethanol

The uses for ethanol

Ethanol is usually found as a colourless liquid, its structure enables it to perform specific and important tasks. Many of them are listed below:



As a solvent in the production of varnishes and perfumes



A preservative for biological specimen, for example estuarine macrobenthos



For the preparation of flavourings and essences



In many drugs and medicine, such as sleeping pills



A disinfectant



In colouring and staining



As a fuel, mainly in cookers and heating devices

Isomer of ethanol

An isomer is when two molecules have the same molecular formula but differ in the way they are presented in their displayed formula.

Name of isomer: Methoxy methane, also referred to as dimethyl ether

Type of isomerism: Functional group isomerism, this is because the functional group has changed from being alcohol to ether.

The molecular formula for Methoxy methane: CH_3OCH_3

The functional group of Methoxy methane: Ether, this is because Methoxy methane has an alkoxy group -O- in it.

The displayed formulae for Methoxy methane

The uses for Methoxy methane

Unlike ethanol, methoxy methane is a colourless gas; therefore its functions differ from those of ethanol. Some of them are as follows:



A refrigerant



A co-blowing agent for foam



A propellant for aerosol products



A solvent



An extraction agent



A chemical reaction medium



A fuel for repairing, cutting and brazing



A multi-purpose fuel

Propanone






The molecular formula for propanone: CH_3COCH_3

The functional group of propanone: Ketone, this is because propanone has a carbonyl group >C=O .

The displayed formulae for propanone

The uses for propanone

Propanone is usually found to be a colourless liquid with a mild and pleasant odour. Its specific structure allows it to perform and participate in various tasks, some are listed below:

-  Nail varnish remover
-  In the production of rayon
-  A gelatinising agent in explosives
-  A solvent in rubber cement
-  In cleaning fluids

Isomer of Propanone

Name of isomer: Propanal, also known as propionaldehyde

Type of isomerism: Functional group isomerism, this is because the functional group has changed from being ketone to aldehyde.

The molecular formula for Propanal: $\text{CH}_3\text{CH}_2\text{CHO}$

The functional group of Propanal: Aldehyde, this is because propanal consists of the carbonyl group

The displayed formulae for Propanal

The uses for Propanal

Propanal is a colourless liquid with an irritating fruity odour. Propanal is used in some chemical bonding in order to perform certain tasks, such as:



Originates trimethylethene, this is used to produce alkyd resins.



Condensation with tert-butylamine gives it a 3-carbon building block used in organic synthesis

Ethyl Ethanoate








The molecular formula for ethyl ethanoate: $C_4H_8O_2$

The functional group of ethyl ethanoate: Ester, this is due to there being an alkyl group in its structure.

The displayed formulae for ethyl ethanoate:

The uses for ethyl ethanoate:

Ethyl ethanoate is a colourless mixture formed by mixing alcohol with ethanoic acid. Its detailed structure makes it a useful substance in many ways; some are as follows:

-  Nail growth stimulator
-  Perfumes
-  Flavouring
-  Coating formulations such as epoxies, urethanes, cellulose and acrylics
-  Aroma enhancers
-  Printing inks
-  Artificial essences

Isomer of ethyl ethanoate

Name of isomer: 3-hydroxybutanone, also called acetoin or acetyl methyl carbinol

Type of isomerism: Functional group isomerism, this is because the functional group has changed from being ester to carboxylic acid.

The molecular formula for 3-hydroxybutanone: $C_4H_8O_2$

The functional group of 3-hydroxybutanone: Carboxylic acid

The displayed formulae for 3-hydroxybutanone

The uses for 3-hydroxybutanone

3-hydroxybutanone is a colourless or pale yellow to green yellow liquid with a pleasant buttery odour. Its structure differs from ethyl ethanoate; therefore it will have different uses, for example:



Gives butter products their taste



Food flavouring and fragrance



Found in apples, yogurt, asparagus, black currants, blackberry, wheat, broccoli, brussels sprouts, cantaloupe and strawberries.



Additive in cigarettes

Propene

The molecular formula for propene: CH_3CHCH_2

The functional group of propene: Alkenes, this is because ethanol has a carbon to carbon double bond $\text{C}=\text{C}$

The displayed formulae for propene

The uses for propene

Propene is usually a colourless and odourless gas, its structure enables it to perform its responsibilities efficiently; some are listed below:



Produces polypropylene



Various types of packaging



Helps produce acetone and phenol

Isomer of Propene

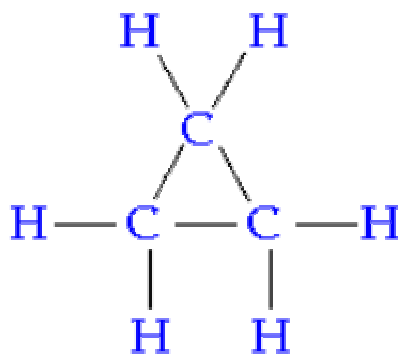
Name of isomer: Cyclopropane

Type of isomerism: Functional group isomerism, this is because the functional group has changed from being alkene to alkane.

The molecular formula for cyclopropane: C_3H_6

The functional group of cyclopropane: Alkane, this is because cyclopropane has a carbon to hydrogen bond.

The displayed formulae for cyclopropane



The uses of cyclopropane

Cyclopropane is a cyclic alkane; this is due to its cyclic structure. Its structure differs a great deal; therefore its uses also differ.



As an anaesthetic



Central nervous system depressant



Explosives

4-aminobenzenecarboxylic Acid

The molecular formula for 4-aminobenzenecarboxylic acid: NH_2COOH

The functional group of 4-aminobenzenecarboxylic acid: Carboxylic Acid, this is because 4-aminobenzenecarboxylic acid contains a carboxyl group.

The displayed formulae for 4-aminobenzenecarboxylic acid

The uses for 4-aminobenzenecarboxylic acid

PABA- ***Para***-aminobenzoic acid (serves as a provitamin for some bacteria)

Isomer of 4-aminobenzenecarboxylic acid

Name of isomer: 2-aminobenzenecarboxylic acid/anthranilic acid

Type of isomerism: Position isomerism, this is because the position of the amino group changed.

The molecular formula for 2-aminobenzenecarboxylic acid: NH_2COOH

The functional group of 2-aminobenzenecarboxylic acid: Carboxylic Acid, this is because 2-aminobenzenecarboxylic acid contains a carboxyl group.

The displayed formulae for 2-aminobenzenecarboxylic acid

The uses for 2-aminobenzenecarboxylic acid

Vitamin L



Production of dyes



Production of pigments



Production of saccharin



Preparing perfumes



Imitates jasmine and orange

4-methylbenzenecarboxylic Acid

The molecular formula for 4-methylbenzenecarboxylic acid:



The functional group of 4-methylbenzenecarboxylic acid: Carboxylic acid, this is because 4-methylbenzenecarboxylic acid consists of a carboxyl group.

The displayed formulae for 4-methylbenzenecarboxylic acid:

The uses for 4-methylbenzenecarboxylic acid



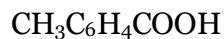
Involved in some industrial processes for the oxidation of p-xylene to terephthalic acid, these are used in the manufacture of PET (Polyethylene terephthalate) which is used in food and liquid packaging.

Isomer of 4-methylbenzenecarboxylic acid

Name of isomer: 2-methylbenzenecarboxylic acid

Type of isomerism: Position isomerism, this is because the position of the methyl group changed.







The molecular formula for 2-methylbenzenecarboxylic acid:



The functional group of 2-methylbenzenecarboxylic acid: Carboxylic acid, this is because 2-methylbenzenecarboxylic acid consists of a carboxyl group.

The displayed formulae for 2-methylbenzenecarboxylic acid

The uses for 2-methylbenzenecarboxylic acid

-  Pharmaceuticals
-  Leather tanning
-  Textile dyeing
-  Plastics
-  Lacquers
-  Solvents

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