

AQA Chemistry A-level

3.3.1: Introduction to Organic Chemistry Detailed Notes

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3.3.1.1 - Nomenclature

There are different way of writing and representing organic compounds:

1. Empirical Formula

- The simplest whole number ratio of atoms of each element in a compound.

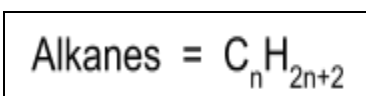
2. Molecular Formula

- The true number of atoms of each element in a compound.

3. General Formula

- All members of a homologous organic series follow the general formula.

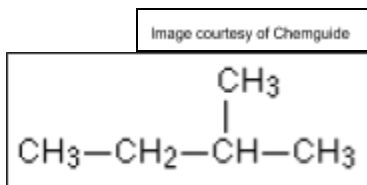
Example:



4. Structural Formula

- Shows the structural arrangement of atoms within a molecule.

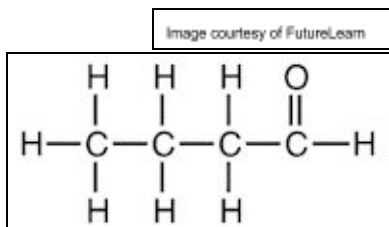
Example:



5. Displayed Formula

- Shows every atom and every bond in an organic compound.

Example:



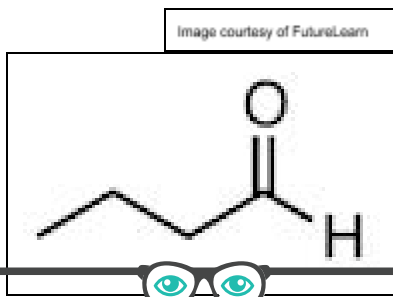
6. Skeletal Formula

- Shows only the bonds in a compound and any non-carbon atoms.

- Vertices are carbon atoms.

- Hydrogen is assumed to be bonded to them unless stated otherwise.

Example:



Homologous Series

Organic compounds are often part of a **homologous series**, in which all members follow a **general formula** and react in a very similar way. Each consecutive member **differs by CH_2** and there is an **increase in boiling points** as chain length increases.

Example:

Image courtesy of DP Chemistry

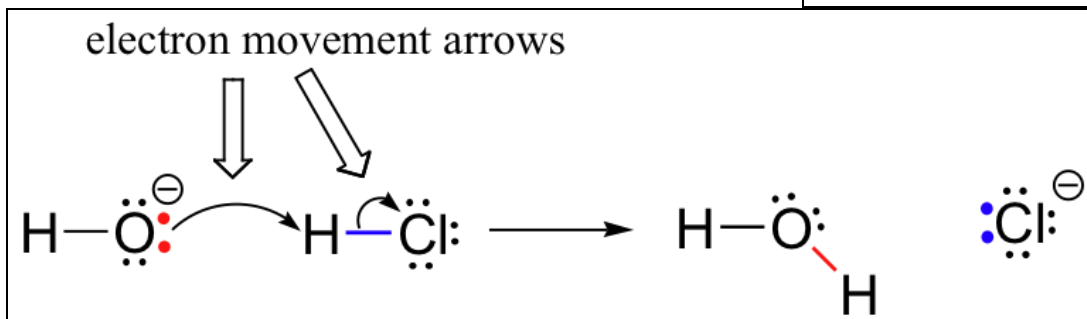
Molecular Formula	Condensed Structural Formula	Name	Boiling Point (°C)
CH_4	CH_4	Methane	-161
C_2H_6	CH_3CH_3	Ethane	-89
C_3H_8	$\text{CH}_3\text{CH}_2\text{CH}_3$	Propane	-44
C_4H_{10}	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$	Butane	-0.5
C_5H_{12}	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Pentane	36
C_6H_{14}	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Hexane	68
C_7H_{16}	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Heptane	98
C_8H_{18}	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Octane	125
C_9H_{20}	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Nonane	151
$\text{C}_{10}\text{H}_{22}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Decane	174

3.3.1.2 - Reaction Mechanisms

These show the **movement of electrons** within a reaction, shown with **curly arrows**.

Example:

Image courtesy of Chemistry LibreTexts



Mechanisms are used to show the reactions of organic compounds.





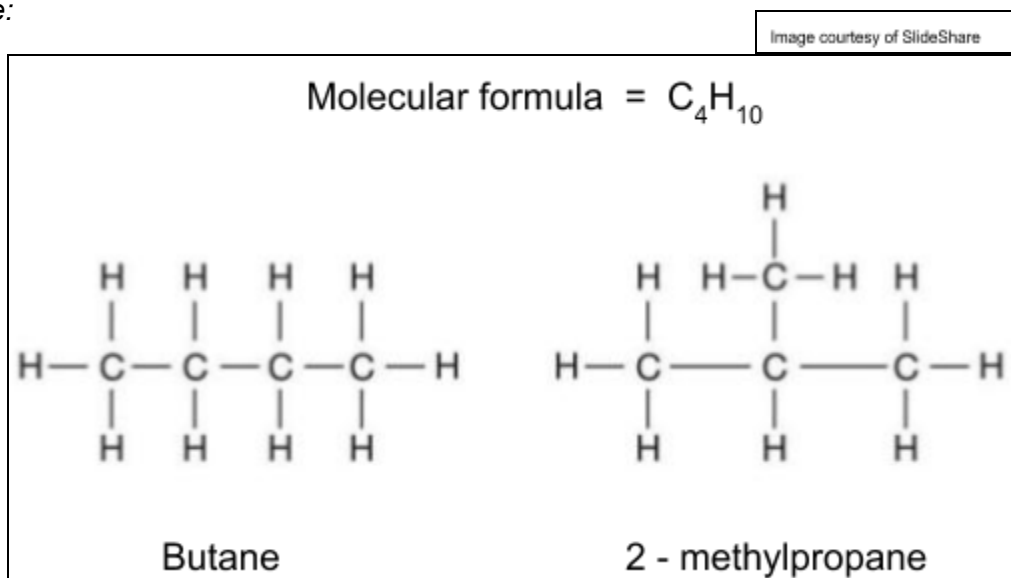
3.3.1.3 - Isomerism

Isomers are molecules with the **same molecular formula** but a **different arrangement** of atoms within the molecule.

Structural Isomers

These have a **different structural arrangement** of atoms. They can be **straight** chains or **branched** chains but will have the same molecular formula.

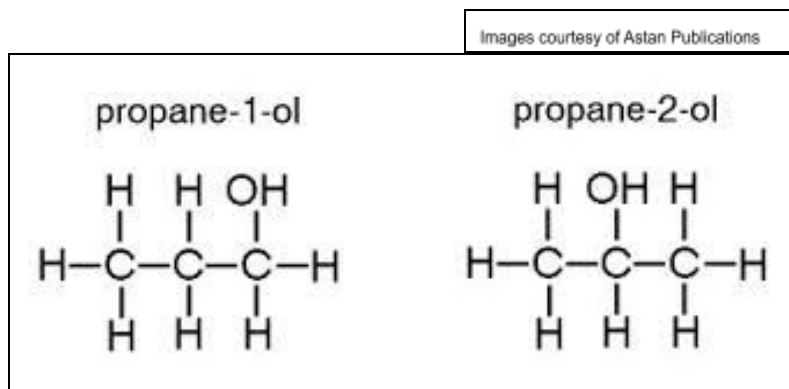
Example:



Position Isomers

These have the **functional group** of the molecule in a **different position** of the carbon chain.

Example:



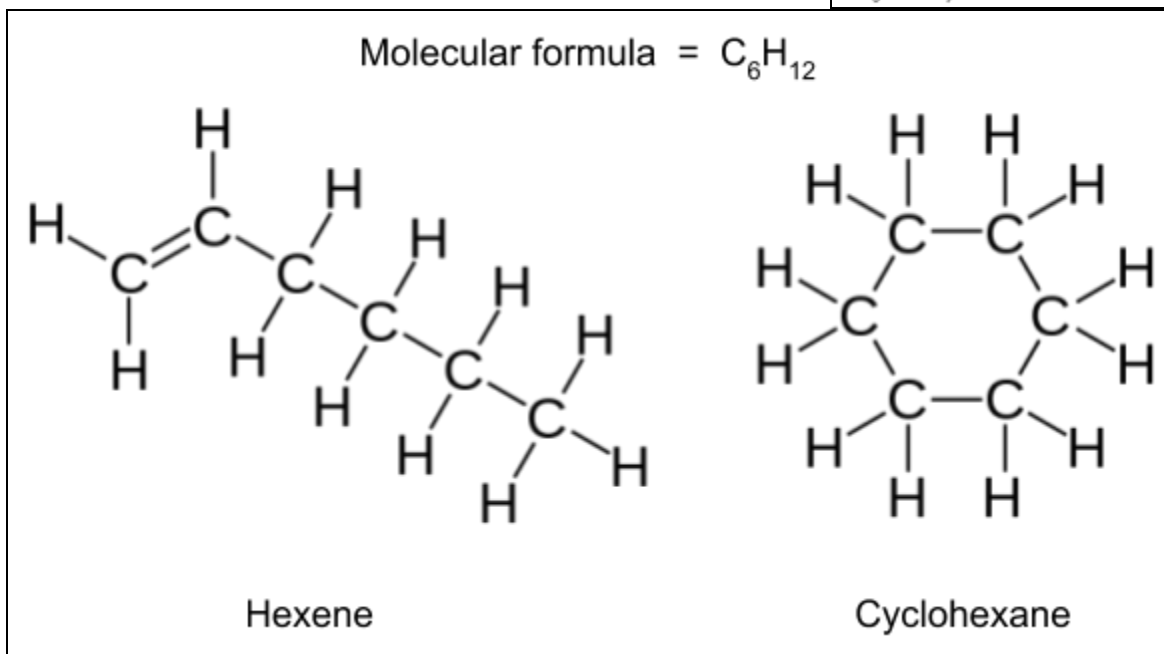


Functional Group Isomers

These have a different arrangement of the same molecular formula so that the molecule has a **different functional group**.

Example:

Image courtesy of Wikimedia Commons

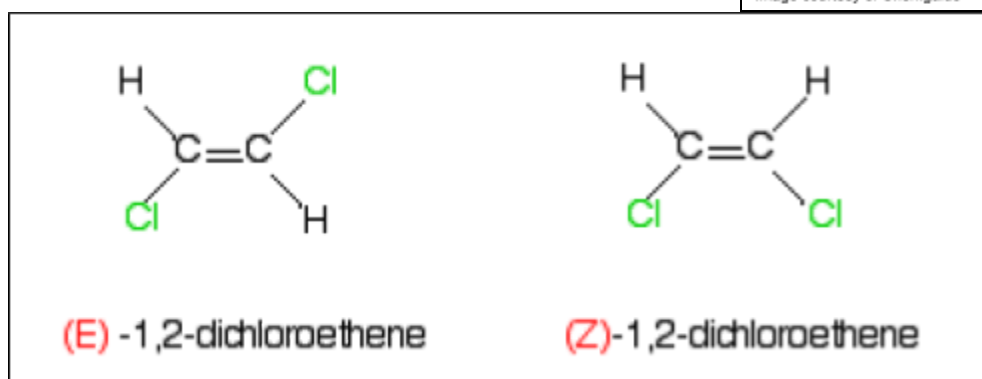


Stereoisomers

These have a **different spatial arrangement**. A type of stereoisomerism is **E-Z isomerism**, where **limited rotation** around a double carbon bond means that groups can either be 'together' or 'apart'. The **E** isomer (german for entgegen meaning apart) has these groups **apart**. The **Z** isomer (german for zusammen meaning together) has these groups **together** on the same side of the double bond.

Example:

Image courtesy of Chemguide

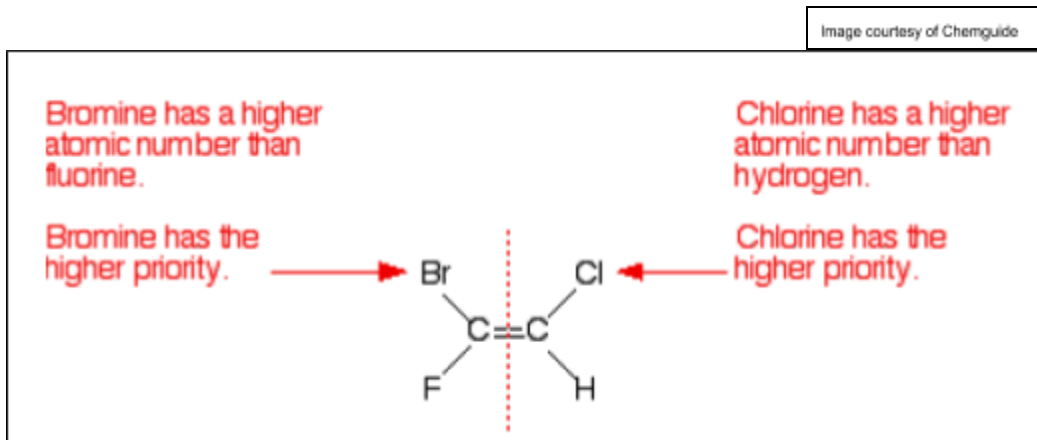




Cahn-Ingold-Prelog (CIP) Priority Rules

There is a **priority of different groups** in molecules that can display E-Z isomerism. The atom or group on each side of the double bond with the **higher Ar or Mr** is given the **higher priority**. These groups are used to determine if it is the E or Z isomer.

Example:



Therefore this molecule is the Z isomer as the highest priority atoms are on the same side.

