

INTRODUCTION to ORGANIC CHEMISTRY

112-term 2

The curly arrows show the movement of pairs of electrons

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HOW TO...

NAME A MOLECULE

1 Find the longest chain of carbons.

Length	Name
1	meth-
2	eth-
3	prop-
4	but-
5	pent-
6	hex-

GENERAL FORMULA
The simplest formula to represent the molecules in a homologous series, e.g. C_nH_{2n+2} .

FUNCTIONAL GROUPS

A collection of atoms in a molecule which determines the reactions of the compound.

HOMOLOGOUS SERIES

Molecules with the same functional groups but different numbers of carbons belong to a homologous series. You can write a general formula for a homologous series.

The simplest homologous series is the alkanes, which has the general formula C_nH_{2n+2} . This means that an alkane with 'n' carbons has '2n + 2' hydrogens. Octane has eight carbons and $(2 \times 8) + 2 = 18$ hydrogens.

DEFINITIONS

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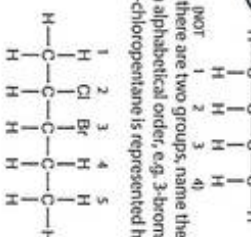
Alkanes, with no functional groups, end in -ane. For functional groups, change the name as follows:

Formula	Prefix	Suffix
$\begin{array}{c} R \\ \diagup \\ C \\ \diagdown \\ R \end{array}$		-ene
R-OH	hydroxy-	-ol
R-CHO		-al
R-CO-R		-one
R-COOH		-oic acid
R-F	fluoro-	
R-Cl	chloro-	
R-Br	bromo-	
R-I	iodo-	

If there are two or three of a functional group, you add di- or tri- before the prefix or suffix.

Groups are numbered based on which carbon they are on in the chain. Counting from the nearest end:

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If there are two groups, name them in alphabetical order, e.g. 3-bromo-2-chloropentane is represented here:



MECHANISMS

When two molecules react, bonds are broken and formed. This involves moving electrons from one place to another. Reaction mechanisms are a way of representing the movement of electrons.

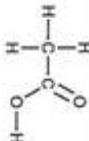
RADICALS

Radicals have an unpaired electron. A small dot is used to represent the unpaired electron.



EXAMPLES

EXAMPLE 1



- There are two carbons in the longest chain, so eth-.
- No branches.
- Carboxylic acid, so -oic acid.

ethanoic acid

EXAMPLE 2



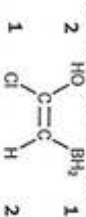
- There are four carbons in the longest chain, so but-.
- CH₃ branch, so -methyl-.
- Alcohol, so -ol.

2-methylbutan-1-ol

CAHN-INGOLD-PRELOG RULES

E/Z isomerism uses CIP rules to name the molecules:

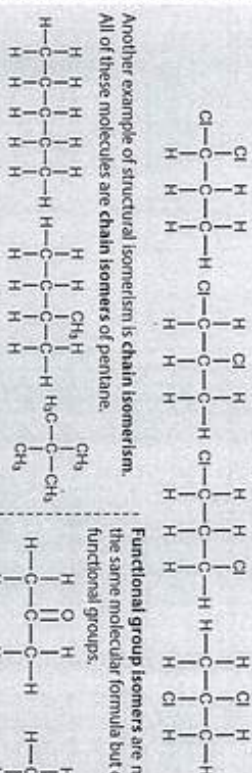
- In E-isomers, the two highest-mass groups are on opposite sides of the double bond.
- In Z-isomers, the two highest-mass groups are on the same side of the double bond.



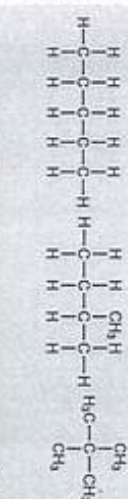
On the left carbon, Cl has a higher mass than O. On the right carbon, Br has a higher mass than H. This molecule has highest-mass groups on opposite sides of the double bond, so is an E isomer.

STRUCTURAL ISOMERISM

Two molecules with the same molecular formula but different structural formulae are called structural isomers. All four of these molecules have the formula C_4H_9Cl , but are position isomers.



Another example of structural isomerism is chain isomerism. All of these molecules are chain isomers of pentane.



Functional group isomers are molecules with the same molecular formula but different functional groups.



STEREOISOMERISM

STEREOISOMERS

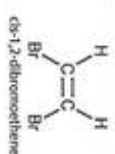
Two molecules are stereoisomers if they have the same structural formula but different arrangements of atoms in space.



The Br and H atoms on either side of the double bond cannot swap because of the restricted rotation around the double bond. The two molecules above are, therefore, stereoisomers. This type of stereoisomerism, with restricted rotation, is called E/Z stereoisomerism.

CIS-TRANS ISOMERISM

Cis-trans isomerism is a special case of E/Z isomerism where there is an identical substituent and another group on each carbon. In cis-isomers, the identical groups are on the same side.



In trans-isomers, the identical groups are on opposite sides.



E/Z ISOMERISM

E/Z is a way of naming the stereoisomers of a molecule. E and Z stand for two German words – *Entgegen* ('opposite') and *Zusammen* ('same').

