

ORGANIC MOLECULES

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Lesson Description

In this lesson we:

- Look at different organic compounds
- Look at how to name and identify organic compounds
- Define some important terms.

Summary

An organic molecule is a compound that contains carbon atoms.

Hydrocarbons are organic molecules that contain carbon and hydrogen atoms.

 A homologous series is a series of compounds that have the same functional group and are described by the same general formula. The consecutive members of the series differ from each other by the same group of atoms, namely $-CH_2$

The functional group is the atom or group of atoms that determine the characteristic properties and reactions of a compound. The functional group is used to classify and name the compound.

Homologous series	Structure / functional group	Suffix
Alkanes	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} $	-ane
Alkenes	$ \begin{array}{c} \diagup \quad \diagdown \\ \text{C}=\text{C} \\ \diagdown \quad \diagup \end{array} $	-ene
Alkynes	$ -\text{C}\equiv\text{C}- $	-yne
Alkyl halides (haloalkanes)	$ \begin{array}{c} \\ -\text{C}-\text{X} \\ \\ (\text{X} = \text{F}, \text{Cl}, \text{Br or I}) \end{array} $	
Alcohols	$ \begin{array}{c} \\ -\text{C}-\text{O}-\text{H} \\ \end{array} $	-ol
Aldehydes	$ \begin{array}{c} \text{O} \\ \\ -\text{C}-\text{H} \end{array} $	-al

notes for...

Homologous series	Structure / functional group	Suffix
Ketones	$\begin{array}{c} & & \text{O} & & \\ & & & & \\ -\text{C} & - & \text{C} & - & \text{C}- \\ & & & & \end{array}$	-one
Carboxylic acid	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}-\text{H} \end{array}$	-oic acid
Esters	$\begin{array}{c} \text{O} & & \\ & & \\ -\text{C}-\text{O}- & \text{C}- \\ & & \end{array}$	-yl ___-oate

When naming an organic compound there is always a prefix, root and suffix

The prefix indicates the number of repeated groups, the root indicates the number of carbon atoms in the longest continuous chain and the suffix shows the homologous series that the compound belongs to.

Number of groups	Prefix	Number of C atoms	Root
2	di-	1	Meth-
3	Tri-	2	Eth-
4	Tetra	3	Prop-
		4	But-
		5	Pent-
		6	Hex-
		7	Hept-
		8	Oct-

Important Terms

Hydrocarbon

A compound containing only carbon and hydrogen atoms

Saturated hydrocarbon

Organic compound containing only single bonds between the carbon atoms

Unsaturated hydrocarbon

Organic compound containing a double or triple bond between two carbon atoms

Isomers

Compound with the same molecular formula but different structural formulae



Test Yourself

Select the most correct answer from the options given. Write down only the correct letter

Question 1

Which one of the following organic molecules has the molecular formula $C_4H_8O_2$?

- A. Ethyl ethanoate
- B. Ethyl methanoate
- C. Methyl ethanoate
- D. Methyl methanoate

Question 2

An example of an unsaturated hydrocarbon is

- A. C_2HCl_5
- B. C_3H_6
- C. C_2H_6
- D. C_2H_5OH

Question 3

Which one of the following compounds is an isomer of Propanoic acid ($C_3H_6O_2$)?

- A. Ethyl ethanoate
- B. Methyl ethanoate
- C. Propan-1,2,3-triol
- D. 3-methylpropan-1-ol

Question 4

Which on the following statements regards the compound $C_3H_6O_2$ is correct?

- A. It is an alcohol
- B. It is an ester
- C. It's functional group is $-COOH$
- D. It is used in an oxy-acetylene torch

Question 5

Which one of the following compounds has the formula $C_2H_4O_2$?

- A. Ethanol
- B. Methyl ethanoate
- C. Ethanoic acid
- D. Butanol



Improve your skills

Question 1

Draw the structural formulae for the following compounds:

- 1.1. heptane
- 1.2. 2-butene
- 1.3. 2-methylpropene
- 1.4. Methanal
- 1.5. Methyl ethanoate
- 1.6. Propanol

Question 2

(Adapted from November 2010 Paper 2 – Question 3)

The chemical properties of organic compounds are determined by their functional groups. The letters A to F in the table below represent six organic compounds.

A $ \begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{C} & = & \text{C} & - \text{C} - \text{H} \\ & & & \\ \text{H} & & \text{H} & \text{H} \end{array} $	B $ \begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{H} \quad \quad \quad \text{H} \\ \quad \quad \quad \\ \text{H} - \text{C} - \text{C} - \text{C} - \text{H} \\ \quad \quad \quad \quad \\ \text{Br} \quad \text{H} \quad \quad \text{H} \end{array} $	C $ \begin{array}{ccccccc} & & & & \text{H} & & \\ & & & & & & \\ & & & & \text{H} - \text{C} - \text{H} & & \\ & & & & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} - \text{C} & - \text{C} - \text{H} \\ & & & & & \\ \text{H} & \text{H} & & \text{H} & \text{H} & \text{H} \\ & & & & & \\ & & & \text{H} - \text{C} - \text{H} & & \\ & & & & & \\ & & & \text{H} & & \\ & & & & & \\ & & & \text{H} & & \\ & & & & & \\ & & & \text{H} & & \end{array} $
D <p style="text-align: center;">Methanal</p>	E $ \begin{array}{ccc} \text{H} & \text{O} & \\ & & \\ \text{H} - \text{C} & - \text{C} & - \text{O} - \text{H} \\ & & \\ \text{H} & & \end{array} $	F <p style="text-align: center;">Methyl methanoate</p>

- 1.1. Write down the letter that represents the following:
 - 1.1.1. An alkene
 - 1.1.2. An aldehyde
- 1.2. Write down the IUPAC name of the following
 - 1.2.1. Compound B
 - 1.2.2. Compound C
- 1.3. Write down the structural formula of compound D
- 1.4. Write down the IUPAC name of the carboxylic acid shown in the table
- 1.5. Write down the structural formula of compound F.


Links

- Alkanes and alkenes http://www.youtube.com/watch?v=rnCGcxn_41g
- Introduction to hydrocarbons <http://www.youtube.com/watch?v=1LV-vgu6cQ>