

# Masters for transparencies

## 5.1

### Matter and materials

materie en materialie

Eliminatie-reactie

- Dehidrohalogenering  
Hint: basis opgelos in ethanol → Alleen + water + halidesout
- Dehidriering  
Hint: zwaarzuur → Alleen + water
- Termische krekking  
Toestand: hoë temperatuur; hoë druk; geen katalysator → Mengsel van alkeno vorm.
- Katalytiese krekking  
Laer temperatuur; 'n katalysator; gematigde lae druk → Kort ketting alkeno vorm.

1.7.2.1 Dehidrohalogenering

Reaksie-toestand:  $\text{NaOH}$   
Temperatuur: Word sterk verhit  
Toestand: Stank bakke  $\text{NaOH}$  of  $\text{KOH}$  in suwer etanol opgelos; warm etanoliese  $\text{NaOH}$  of  $\text{KOH}$ .  
Produkt: Alleen + water +

$\begin{array}{c} \text{---C---C---} \\ | \quad | \\ \text{H} \quad \text{Y} \end{array}$

Voorbeelde:

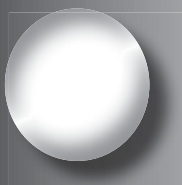
$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{H---C---C---H} \\ | \quad | \\ \text{H} \quad \text{Br} \end{array} + \text{Na---O} \xrightarrow[\Delta]{\text{etanol}}$

bromostaan

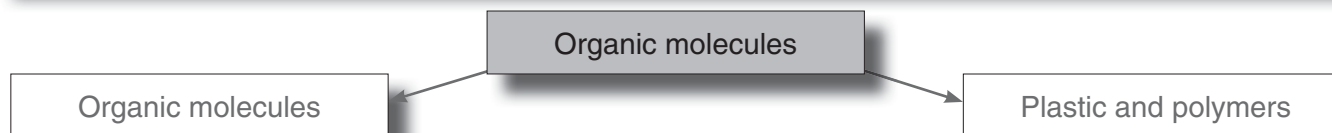
$\begin{array}{c} \text{H} \quad \quad \text{H} \\ \backslash \quad / \\ \text{C} = \text{C} \\ / \quad \backslash \\ \text{H} \quad \quad \text{H} \end{array} + \text{Na---Br} + \text{H---O}$

eteen

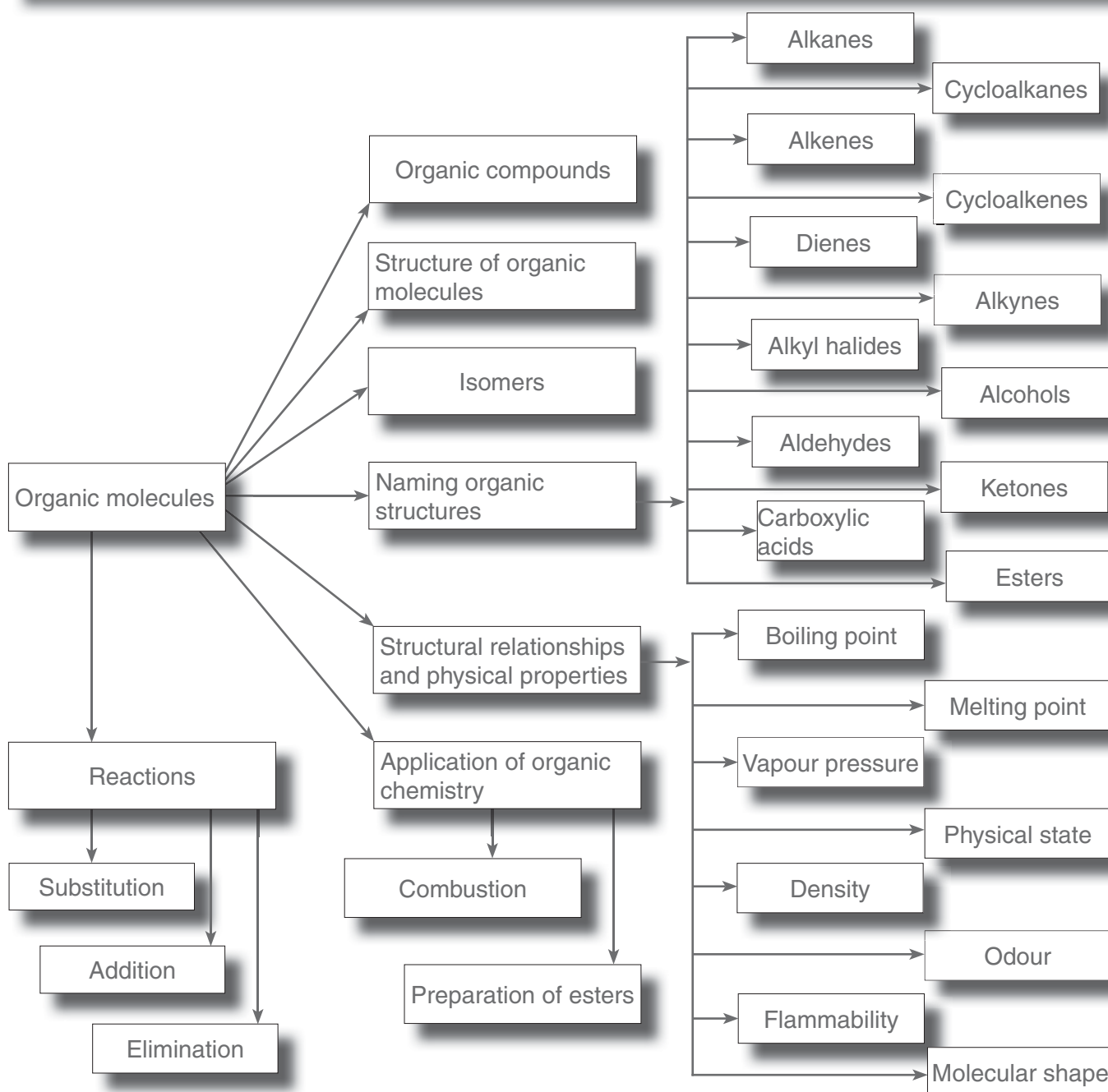
126 CHEMIE voorbereidingsles - Graad 12 Die Boekie



# KNOWLEDGE AREA: MATTER AND MATERIALS



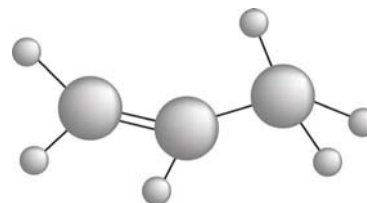
## UNIT 1 ORGANIC MOLECULES





## 1.1 Organic compounds

An organic molecule is a compound that contains carbon atoms.



### Quick facts

The following carbon compounds are exceptions and are regarded as inorganic compounds:

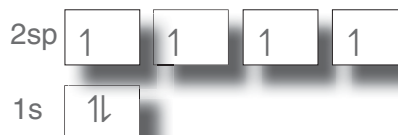
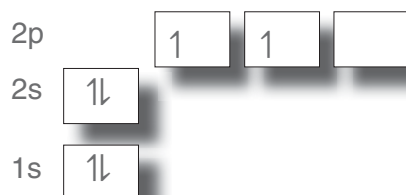
- Carbon monoxide (CO)
- Carbonates ( $\text{CO}_3^{2-}$ )
- Carbon dioxide ( $\text{CO}_2$ )
- Cyanides ( $\text{CN}^-$ )

Carbon is the basic building block of living organic compounds that recycle through the earth's air, water, soil and living organisms.

What makes carbon so unique that it is responsible for such a great number of compounds?

Carbon's electron distribution:

1. Carbon is found in group IV of the Periodic Table and has four valence electrons.



2. Carbon forms a maximum of four covalent compounds with other carbon atoms.
  - These compounds can be single, double or triple.
  - Long carbon chains or chains with branches, and even ring structures can be formed this way.
3. Carbon forms covalent compounds with other atoms like hydrogen, oxygen, nitrogen, halogens, etc.



## 1.2 Structure of organic molecules

A homologous series is a series of compounds with the same functional group and is described by the same general formula. The members in the series differ, but have a common group of atoms, or structure.

A **functional group** is a compound, an atom or a group of atoms that determines the distinctive properties and reactions of the compound. The functional group is used with the naming and classification of a compound.

Functional groups of organic compounds are:

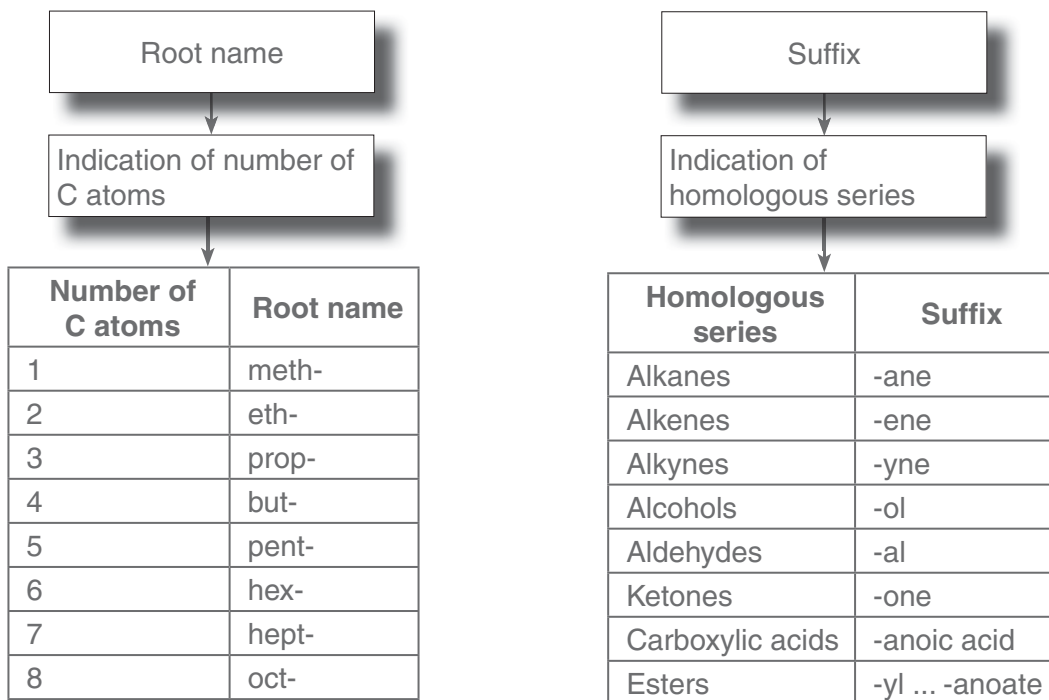
Homologous series	Structure or functional group	Example of compound	
		Name	Structural formula
Alkanes	only $\begin{array}{c}   \\ - C - H \\   \end{array}$ and $\begin{array}{cc}   &   \\ - C & - C - \\   &   \end{array}$ single bonds	Ethane	$\begin{array}{cc} H & H \\   &   \\ H - C & - C - H \\   &   \\ H & H \end{array}$
Alkenes	$\begin{array}{c} \diagdown & \diagup \\ & C = C \\ \diagup & \diagdown \end{array}$	Ethene	$\begin{array}{cc} H & H \\ \diagdown & / \\ & C = C \\ / & \diagdown \\ H & H \end{array}$
Alkynes	$- C \equiv C -$	Ethyne	$H - C \equiv C - H$
Alkyle halides (haloalkanes)	$\begin{array}{c}   \\ - C - X \\   \end{array}$ (X = F, Cl, Br, I)	Bromoethane	$\begin{array}{cc} H & H \\   &   \\ H - C & - C - Br \\   &   \\ H & H \end{array}$



Homologous series	Structure or functional group	Example of compound	
		Name	Structural formula
Alcohols	$\begin{array}{c}   \\ - \text{C} - \text{O} - \text{H} \\   \end{array}$	Ethanol	$\begin{array}{ccccccc} & & \text{H} & & \text{H} & & \\ & &   & &   & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{O} - \text{H} \\ & &   & &   & & \\ & & \text{H} & & \text{H} & & \end{array}$
Aldehydes	$\begin{array}{c} \text{O} \\    \\ - \text{C} - \text{H} \end{array}$	Ethanal	$\begin{array}{ccccccc} & & \text{H} & & \text{O} & & \\ & &   & &    & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{H} \\ & &   & & & & \\ & & \text{H} & & & & \end{array}$
Ketones	$\begin{array}{c} \text{O} \\    \\ - \text{C} - \text{C} - \text{C} - \\   \qquad \qquad   \end{array}$	Propanon	$\begin{array}{ccccccc} & & \text{H} & & \text{O} & & \text{H} \\ & &   & &    & &   \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} - \text{H} \\ & &   & & & &   \\ & & \text{H} & & & & \text{H} \end{array}$
Carboxylic acids	$\begin{array}{c} \text{O} \\    \\ - \text{C} - \text{O} - \text{H} \end{array}$	Ethanoic acid	$\begin{array}{ccccccc} & & \text{H} & & \text{O} & & \\ & &   & &    & & \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{O} - \text{H} \\ & &   & & & & \\ & & \text{H} & & & & \end{array}$
Esters	$\begin{array}{c} \text{O} \\    \\ - \text{C} - \text{O} - \text{C} - \\   \qquad \qquad   \end{array}$	Methyl ethanoate	$\begin{array}{ccccccc} & & \text{H} & & \text{O} & & \text{H} \\ & &   & &    & &   \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{O} - \text{C} - \text{H} \\ & &   & & & &   \\ & & \text{H} & & & & \text{H} \end{array}$



To identify or name a compound, the following is used:



The formulae for organic compounds that will be used in Grade 12 are:

Type of formula	Example	
	Name	Formula
Molecular formula	Propane	$C_3H_8$
Condensed formula	Propane	$CH_3CH_2CH_3$
Structural formula	Propane	$  \begin{array}{ccccccc}  & H & & H & & H & \\  &   & &   & &   & \\  H & - C & - & C & - & C & - H \\  &   & &   & &   & \\  & H & & H & & H &   \end{array}  $



Examples of structural and condensed formulae:

Structural formula	Condensed formulae
$  \begin{array}{ccccccccccc}  & \text{H} & & \text{H} & & \text{H} & & \text{H} & & & \\  &   & &   & &   & &   & & & \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} & \\  &   & &   & &   & &   & & & \\  & \text{H} & & \text{H} & & \text{H} & & \text{H} & & &   \end{array}  $	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ <b>or</b> $\text{CH}_3(\text{CH}_2)_2\text{CH}_3$ NOTE: groups that repeat may be written in brackets with the amount of times it repeats after it.
$  \begin{array}{ccccccccccc}  & \text{H} & & \text{H} & & \text{H} & & \text{H} & & & \\  &   & &   & &   & &   & & & \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} & \\  &   & &   & &   & &   & & & \\  & \text{H} & & \text{H} & & & & \text{H} & & & \\  & & & & & & &   & & & \\  & & & & & & & \text{H} - \text{C} - \text{H} & & & \\  & & & & & & &   & & & \\  & & & & & & & \text{H} & & &   \end{array}  $	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$ <b>or</b> $\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{CH}_3$ NOTE: branches are written in brackets after the carbon to which it is bonded.
$  \begin{array}{ccccccccccc}  & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H} & \\  &   & &   & &   & &   & &   & \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\  &   & &   & &   & &   & &   & \\  & \text{H} & & \text{H} & & & & \text{H} & & \text{H} & \\  & & & & & & &   & & & \\  & & & & & & & \text{H} - \text{C} - \text{H} & & & \\  & & & & & & &   & & & \\  & & & & & & & \text{H} & & &   \end{array}  $	$\text{CH}_3\text{CH}_2\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{CH}_3$ <b>or</b> $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$ NOTE: Brackets indicate that $\text{CH}_3$ is a branch and bonded to the previous C.
$  \begin{array}{ccccccccccc}  & \text{H} & & & & & & \text{H} & & & \\  &   & & & & & &   & & & \\  \text{H} & - \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{H} & \\  &   & &   & &   & &   & & & \\  & \text{H} & & \text{H} & & \text{H} & & \text{H} & & &   \end{array}  $	$\text{CH}_3\text{CH}=\text{CHCH}_3$ NOTE: Keep the double bond.