

Builder Molecules



Petrochemicals

Derived from petroleum, these chemicals can be used in their distilled form (detergents, pesticides, pharmaceuticals, etc.) and some are used as raw materials to make synthetic substances (plastics, etc.)

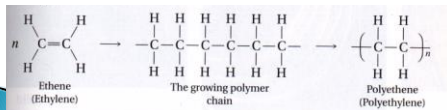
Plastics include paints, rubber, adhesives, and structural materials.



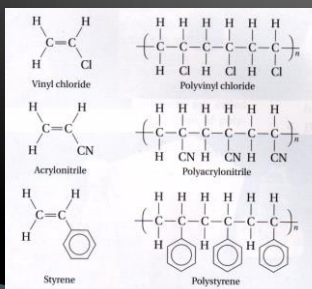
Builder Molecules

To make these plastics, the double bonds of a monomer, such as ethene, is broken, and a string of these monomers are chained together to form polymers. These polymers are called addition polymers.

These polymers are the basis for most plastics that exist today. Plastics are made to different consistency by the length of the polymer and the addition of functional groups.



Examples of Polymers



Alkanes, Alkenes and Alkynes

Alkanes, Alkenes and Alkynes are the basis of an organic substance. You start with one of these, and then can add polymers or functional groups as necessary.

Naming System for Alkanes

A saturated hydrocarbon, with all single bonds is an alkane. The name is determined by the number of carbon atoms and an -ane ending.

Example: CH₃-CH₂-CH₃

- 1 - meth
- 2 - eth
- 3 - prop
- 4 - but
- 5 - pent
- 6 - hex
- 7 - hept
- 8 - oct
- 9 - non
- 10 - dec

Alkene and Alkyne Naming

Alkenes and alkynes are unsaturated organics, with double bonds (alkene) or triple bonds (alkyne).

The naming system has the same prefixes, but the name ends with -ene for alkenes and -yne for alkynes

Examples: $\text{CH}_3\text{-CH=CH-CH}_3$, $\text{CH}_3\text{-C}\equiv\text{C-CH}_3$

Numbering Addition

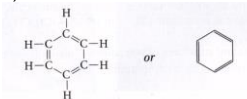
It is necessary to tell where the double and triple bonds are on the molecule. For this purpose, we list a number at the beginning of the name to tell where the double or triple bond is located.

Example: 2-pentene, 3-hexyne

Circular Structures

Any molecule that is circular (3 carbon minimum), have a cyclo- prefix at the beginning. These circular hydrocarbons are called aromatics.

Example: Cyclohexane, cyclohexene



Numbering addition – branches

When an organic has a methyl ($-\text{CH}_3$) branch, we must also list where the branch is coming off of the chain. The molecule's prefix is determined by the length of the longest chain (not including branches), and the number(s) are determined by the places the branch comes off the chain.

Example: 2-methylbutane,
2,3 dimethylhexane



Where are the methyl groups?

Branches on alkenes can be cis (on the same side), or trans (on opposite sides) to the double bond. The cis and trans isomers have different characteristics from one another

Example: cis-2,3-dimethyl-2-hexene,
trans-3,4-dimethyl-3-octene



Functional Groups

A hydrocarbon does not have to be made completely of carbon and hydrogen atoms. If an additional element is included, it is called a functional group.

You are already familiar with one functional group: methyl $-\text{CH}_3$

Halogens ($-\text{F}$, $-\text{Cl}$, $-\text{Br}$, $-\text{I}$) are very often a functional group. They are named similar to that of the methyl group.

Example: 3-bromopentane,
cis-2,3-dichloro-2-butene



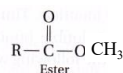
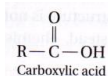
Functional Groups

Alcohols, carboxylic acids and esters can be added to any organic molecule.

Alcohols are present in cleaning products and medicines. (add functional group -OH)

Carboxylic acids are present in natural acids, such as vinegar and fruits. (add C-OH)

Esters make things smell sweet. (add $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}-\text{O}-\text{CH}_3 \end{array}$)



Naming for functional groups

As before, the molecule is named for the number of carbons.

You would put a number showing where the functional group is branching off the organic molecule, and then the "e" on the -ane would be replaced by:

- a) "-ol" for an alcohol,
- b) "-oic acid" for a carboxylic acid, and
- c) "1-methyl" prefix and "-oate" suffix for an ester.

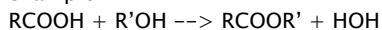
Examples: 2-propanol, 1-butanoic acid, 1-methyl propanoate

Condensation Reactions

A way of forming polymers is by removing functional groups to form long chains.

An example of a condensation reaction is the mixing of a carboxylic acid and an alcohol to form an ester and water.

Basic example:



Recycle Codes for Plastics



PETE-Polyethylene Terephthalate

Product examples: bottles for soft drinks, soy sauce, and cooking oil



HDPE-High Density Polyethylene

Product examples:pails; containers for liquid detergent and fruit juice



V-Polyvinyl Chloride

Product examples:pipes; bottles for shampoo and mineral water

Recycle Codes for Plastics



LDPE-Low Density Polyethylene

Product examples: shopping bags; housewares



PP-Polypropylene

Product examples: household storage containers



PS-Polystyrene

Product examples: foam products like drinking cups and food trays



OTHER- Other type of less commonly used plastics

Product examples: bottles for ketchup and syrup

Heat Review

- ▶ Hexane burns in the presence of oxygen. The enthalpy of the reaction is -9618 kJ .
- ▶ A) How much energy is released when 24.6 g of hexane is burned?
- ▶ B) How many grams of oxygen are burned when 3670 kJ of energy is released?
