

Hydrocarbons - Chapter 16

Definition of Homologous Series

- A homologous series is a family of compounds that share the same functional group and thus, have the same general formula and similar chemical properties.

Alkanes

Alkanes are hydrocarbons that contain only *carbon-carbon single bonds* and *carbon-hydrogen bond*.

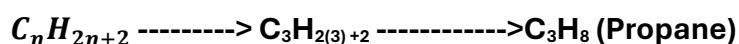
1. General Formula -----> C_nH_{2n+2}

Name - Molecular Formula - Structural Formula

- Methane - CH_4 -- CH_4
- Ethane - C_2H_6 - CH_3CH_3
- Propane - C_3H_8 - $CH_3CH_2CH_3$

Following General Formula,

n=3(propene)



Combustion

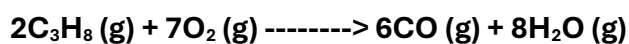
Alkanes burn excess oxygen to produce carbon dioxide and water

Propane + Oxygen ----> Carbon Dioxide + Water

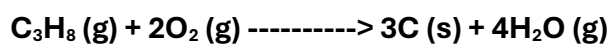


When there is insufficient oxygen carbon monoxide and soot are formed instead

Propane + Oxygen -----> Carbon Monoxide + Water



Propane + Oxygen -----> Carbon + Water



* Alkenes are more likely to go through incomplete combustion

- Incomplete Combustion --> More likely to give out carbon, carbon monoxide.
- Incomplete Combustion --> Burn sootier flames than alkanes.

Substitution

A chemical process where a halogen atom *replaces* a hydrogen atom to form a *new organic product* and a *by-product*.

Reaction with *halogens*(chlorine or bromine) in *UV Light/Sunlight*

Methane + Chlorine ---UV Light-----> Chloromethane + Hydrogen Chloride



CH_3Cl --> Chloromethane

CH_2Cl_2 --> Dichloromethane

CHCl_3 --> Trichloromethane

CCl_4 --> Tetrachloromethane

Alkenes

Physical Properties of Alkenes

Viscosity

- Alkenes become more viscous as their molecular sizes increase.

Solubility

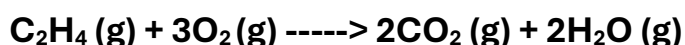
- Alkenes are insoluble in water but soluble in most organic solvents like tetrachloromethane (CCl_4)

Combustion of alkenes

Combustion

-Alkenes burn in excess oxygen to produce carbon dioxide and water.

Ethene + oxygen -----> Carbon Dioxide + water



- * Compared to alkanes, alkenes have a higher percentage by mass of carbon.
- * They are more likely to undergo incomplete combustion
- * They burn with a sootier flame than alkanes

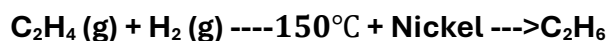
Addition Reactions --> The C=C bond are reactive.

C=C bond breaks to form new single bonds.

Reactants that can be added to alkenes including hydrogen, bromine and other alkenes.

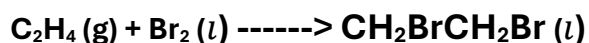
Addition Reaction (Hydrogenation)

Ethene + hydrogen ----150°C + Nickel ---> Ethane



Addition Reaction (Bromination)

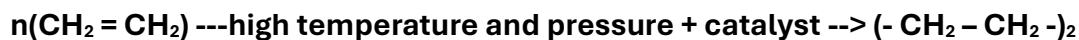
Ethene + Bromine -----> 1,2 – dibromoethane



*** In the reaction, the brown colour of bromine disappears.**

Addition Reaction (Polymerisation)

Ethene ---high temperature and pressure + catalyst --> poly(ethene)



- A long molecule is formed
- The process is used to manufacture materials like plastic

Polymerisation is a process where a large number of *unsaturated monomers* join together to form a *saturated large organic molecule*.

Cracking of Alkenes

A process where larger hydrocarbon molecules, usually alkenes, are broken down into smaller hydrocarbon molecules.

Hexane ---crack---> butane + ethene

