Republic of Iraq Ministry of Higher
Education & Scientific Research
University of Al-Maarif
College of Dentistry

Alkanes and Cycloalkanes

Lec(8)

First stage

By

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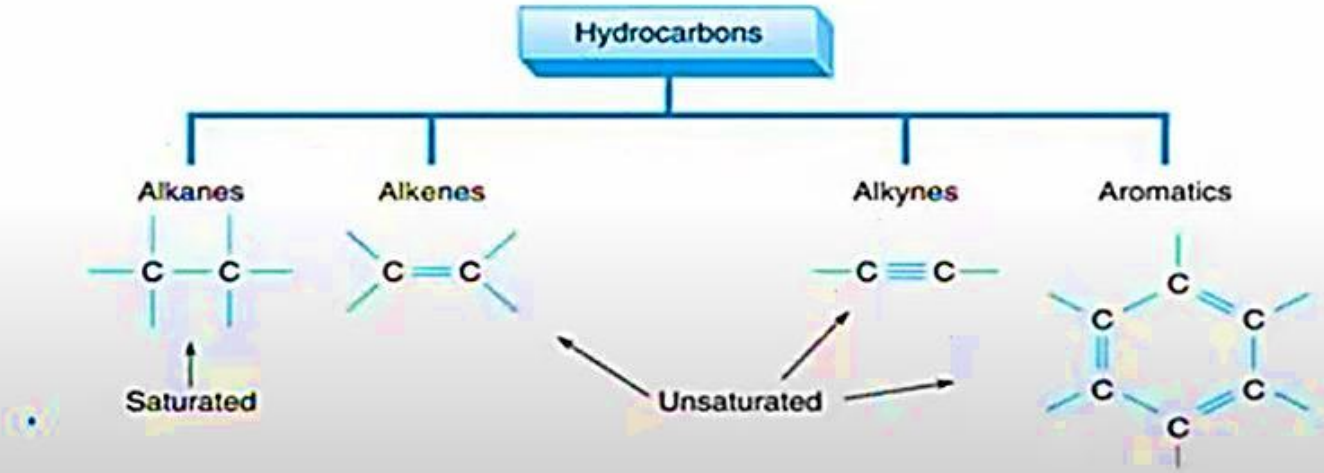
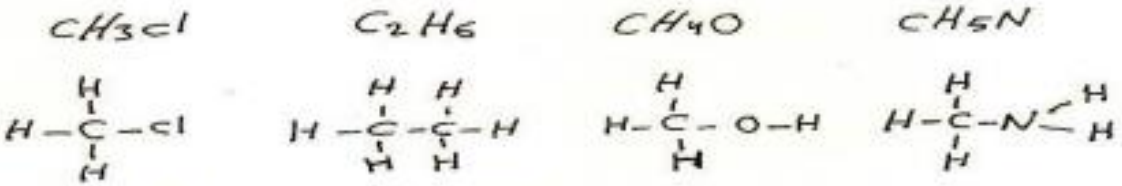
Hydrocarbon

Hydrocarbons : a compound composed of only carbon and hydrogen. (maybe Cl, Br, I)

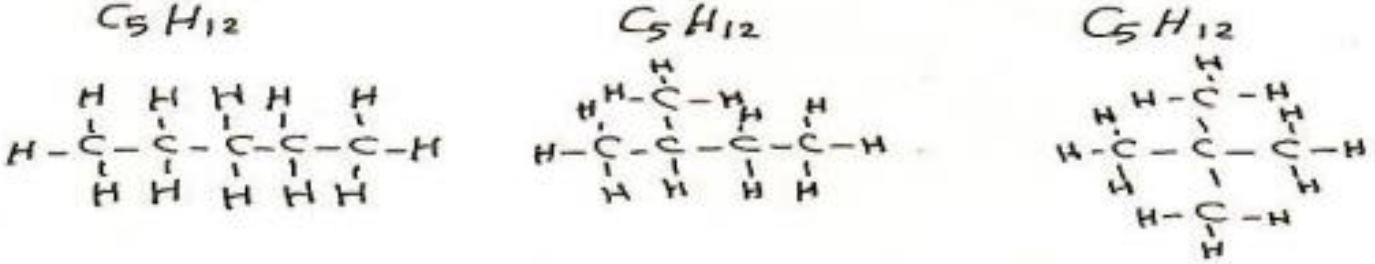


Alkanes and Cycloalkanes

Structural Formulas



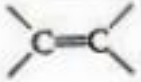
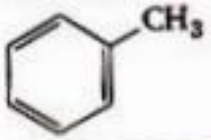
Structural Isomers



Compounds that have the same chemical formulas but differ in their structural formulas are called Structural Isomers

Functional Groups

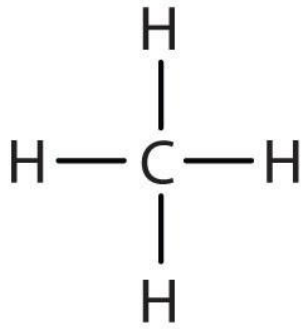
- The chemical reactions of organic compounds occurred at specific sites in the molecules. These sites usually contained specific atoms or groups of atoms bonded to carbon. These groups at which reactions occur are called functional group.

Functional Group	Class of Compound	Example
	Alkene	$H_2C{=}CH_2$
	Alkyne	$HC{\equiv}CH$
	Aromatic	

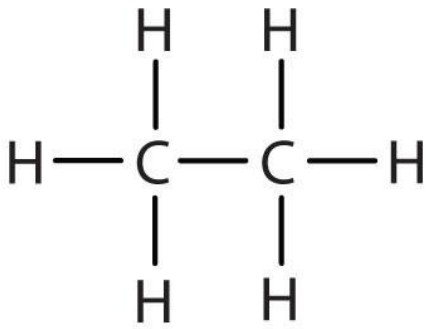
Alkanes

The general formula of alkanes is C_nH_{2n+2}

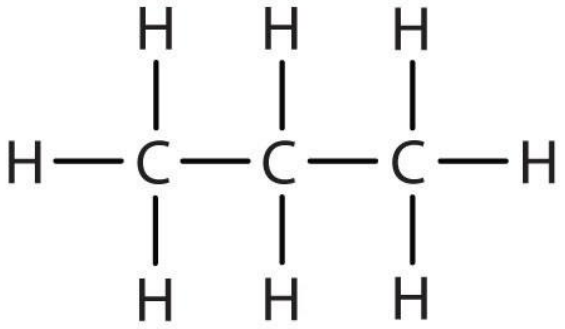
Where n is the number of carbon atoms in the molecule.



Methane



Ethane



Propane

ALKANES

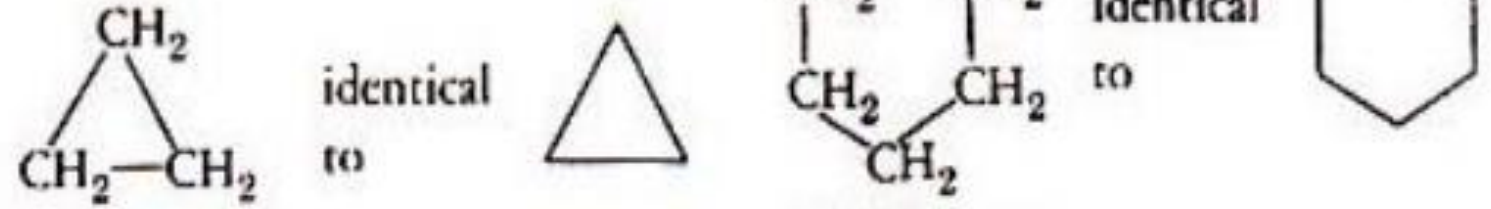
IUPAC naming system:

Molecular formula	Condensed Structural Formula	Name
CH_4	CH_4	**methane**
C_2H_6	CH_3CH_3	**ethane**
C_3H_8	$CH_3CH_2CH_3$	**propane**
C_4H_{10}	$CH_3CH_2CH_2CH_3$	**butane**
C_5H_{12}	$CH_3CH_2CH_2CH_2CH_3$	**pentane**
C_6H_{14}	$CH_3CH_2CH_2CH_2CH_2CH_3$	**hexane**
C_7H_{16}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$	**heptane**
C_8H_{18}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	**octane**
C_9H_{20}	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	**nonane**
$C_{10}H_{22}$	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	**decane**

Naming Alkanes and Cycloalkanes

- Saturated hydrocarbons can also exist as rings. Cyclic compounds of carbon containing only single bonds are called Cycloalkanes.If The compounds contain only one ring, they have the general formula CnH2n

Cycloalkanes are named by adding the prefix cyclo- to the name of the straight – chain hydrocarbon containing the same number of carbon atoms. For example

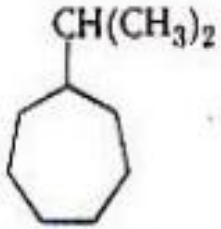


Cyclopropane

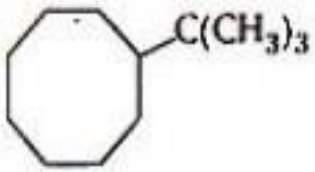
Cyclohexane

All the carbon atoms of a cycloalkane are equivalent. Therefore, no number prefix is needed for monosubstituted cycloalkanes. For example:

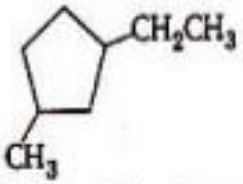
Methylcyclopropane



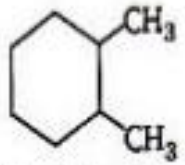
Isopropylcycloheptane



t-Butylcyclooctane

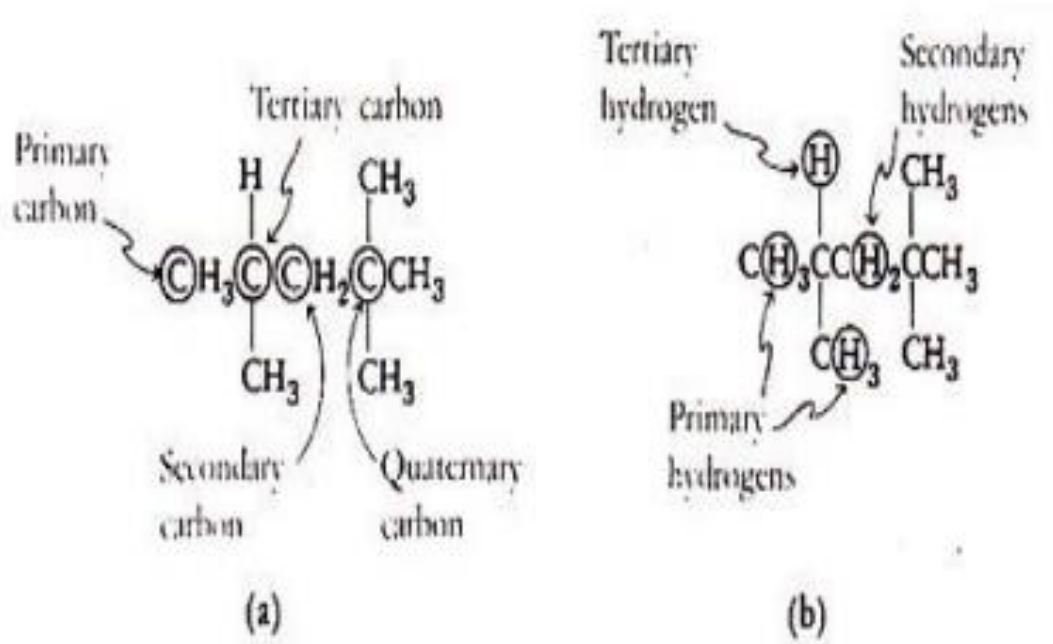


1-Ethyl-3-methylcyclopentane



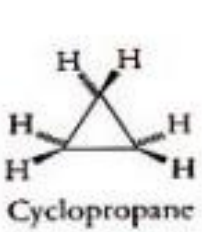
1,2-Dimethylcyclohexane

A carbon atom is designated: primary,secondary,or tertiary according to the number of carbon atoms bonded to it.

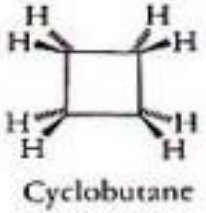


Geometric Isomers

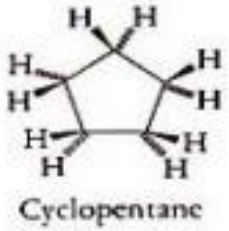
Molecules that differ in the three – dimensional arrangements of their atoms in space.



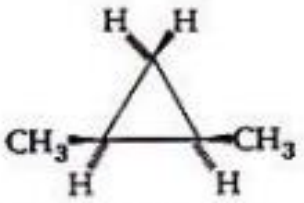
Cyclopropane



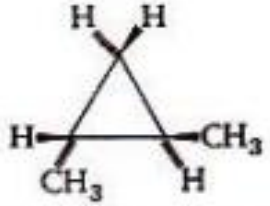
Cyclobutane



Cyclopentane



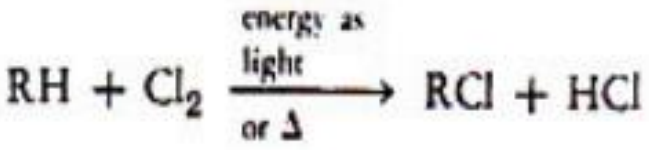
cis-1,2-Dimethylcyclopropane



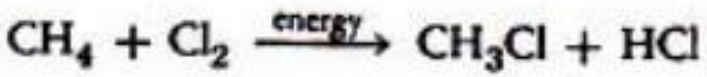
trans-1,2-Dimethylcyclopropane

Chemical Reactions

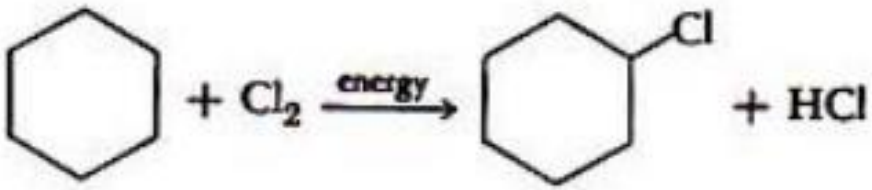
- Chlorination



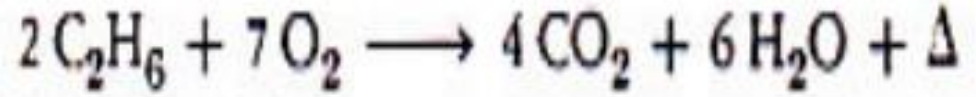
$$RH + Cl_2 \xrightarrow[\text{or } \Delta]{\text{energy as light}} RCl + HCl$$



$$CH_4 + Cl_2 \xrightarrow{\text{energy}} CH_3Cl + HCl$$



Oxidation:In the presence of excess oxygen,alkanes burn to form carbon dioxide,water and energy



If insufficient oxygen ,alkanes form carbon monoxide or carbon