Ministry of Higher Education and Scientific Research
AL-Mustaqbal University College Department of Medical Physics

Organic Chemistry

Lecture 1

Introduction to Organic Chemistry

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Introduction:-

- Organic chemistry is the branch of chemistry that deals with carbon and its compounds. It is fundamental to biology and medicine.
- Organic chemistry is the chemistry of carbon, an element that forms strong chemical bonds to other carbon atoms as well as to many other elements like hydrogen, oxygen, nitrogen, and the halogens.
- Organic chemicals were used in ancient times by Romans and Egyptians as dyes, medicines and poisons from natural sources, but the chemical composition of the substances was unknown .

Nomenclature

1- Find the longest carbon chain in the molecule. This will give you the base of the name:

No of C atoms	Name
1	meth-*ane*
2	eth-*ane*
3	prop-*ane*
4	but-*ane*
5	pent-*ane*
6	hex-*ane*
7	hept-*ane*
8	oct-*ane*
9	non-*ane*
10	dec-*ane*

2- Determine the principle functional group and its position.

principal functional group	formula	ending becomes
alkane	C-C	-ane
alkene	C=C	-ene
alkyne	C≡C	-yne
alcohol	-OH	-anol
aldehyde	-CH=O	-anal
ketone	>C=O	-anone
carboxylic acid	-COOH	-anoic acid

- Position is indicated, where necessary, by numbering the carbons in the main chain.
- Position need not be indicated for alkanes, as they have no functional group, and aldehydes and acids, as they are terminal functional groups.
- Positioning numbers are flanked by dash signs. Multiple positions for a given functional group are separated by commas and indicated by the prefixes di, tri, tetra, penta, hexa, hepta, octa , nona and deca.

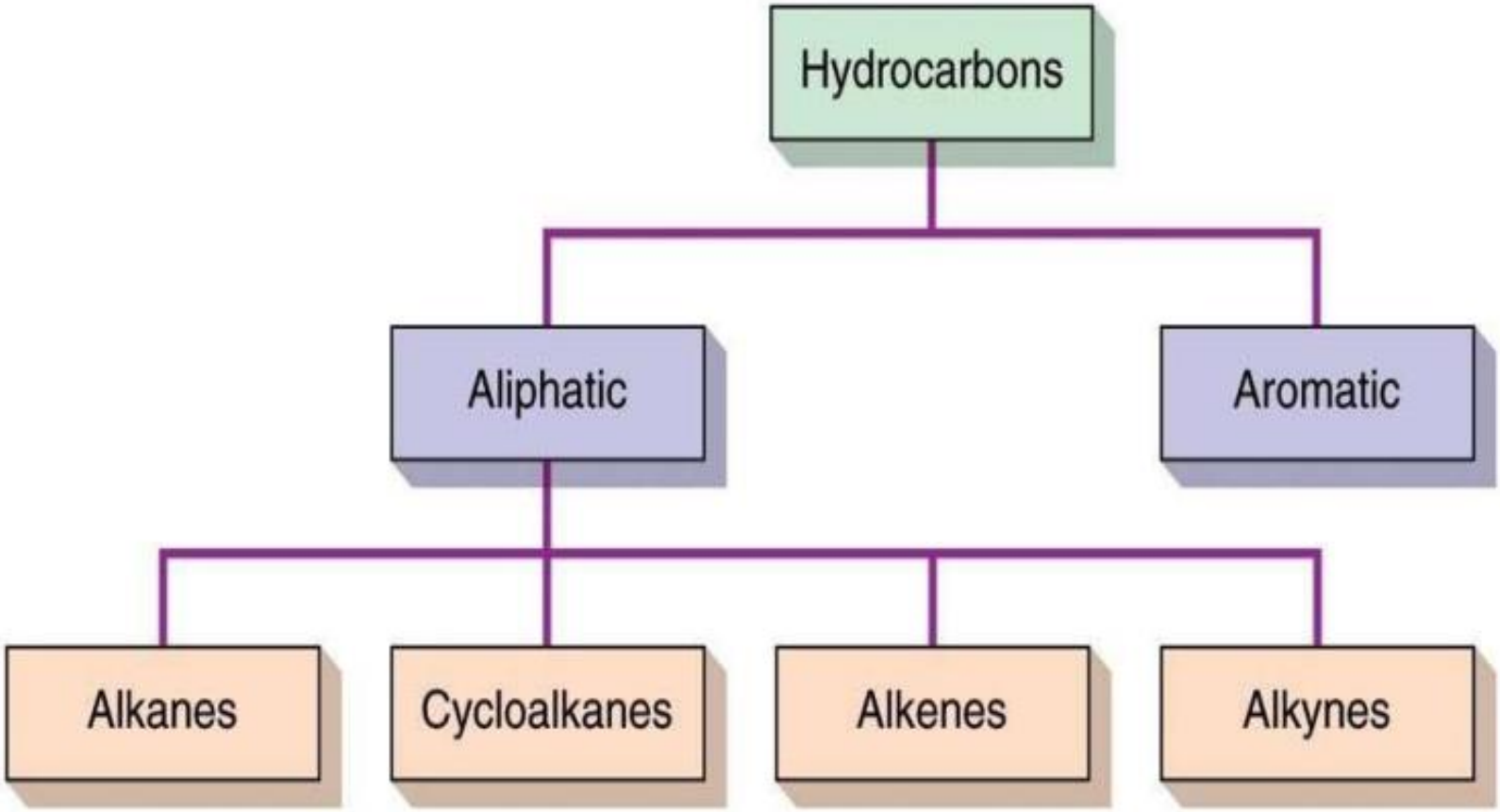
Anciliary functional groups are given in alphabetical order, with their position at the beginning of the name.

ancilliary functional group	formula	prefix
methyl	$-CH_3$	methyl
ethyl	$-C_2H_5$	ethyl
propyl	$-C_3H_7$	propyl
butyl	$-C_4H_9$	butyl
pentyl	$-C_5H_{11}$	pentyl
hexyl	$-C_6H_{13}$	hexyl
heptyl	$-C_7H_{15}$	heptyl
octyl	$-C_8H_{17}$	octyl
nonyl	$-C_9H_{19}$	nonyl
decyl	$-C_{10}H_{21}$	decyl
fluorine	-F	fluoro
chlorine	-Cl	chloro
bromine	-Br	bromo
iodine	-I	iodo
amine	$-NH_2$	amino
hydroxyl	-OH	hydroxy
cyanide	-CN	cyano
benzyl	$-CH_2C_6H_5$	benzyl
phenyl	$-C_6H_5$	phenyl

Hydrocarbons

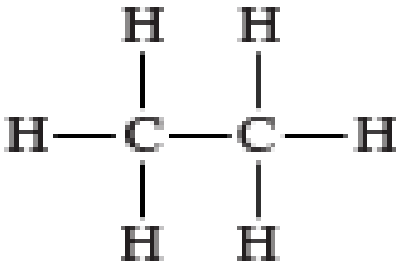
- Hydrocarbons are the most simple organic compounds.
- Hydrocarbons contain only carbon (C) and hydrogen (H.)
- Hydrocarbons can undergo reactions that release a large amount of energy.
- Hydrocarbons can be divided into aromatic and aliphatic hydrocarbons.
- The carbon atoms join together to form the framework of the compound, and the hydrogen atoms attach to them in many different configurations. chemical compound.

Classification of Hydrocarbon

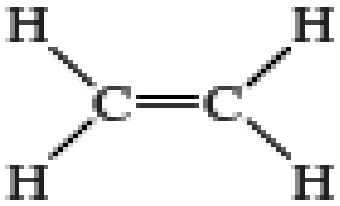


Structures of Representative Hydrocarbons

aliphatic hydrocarbons



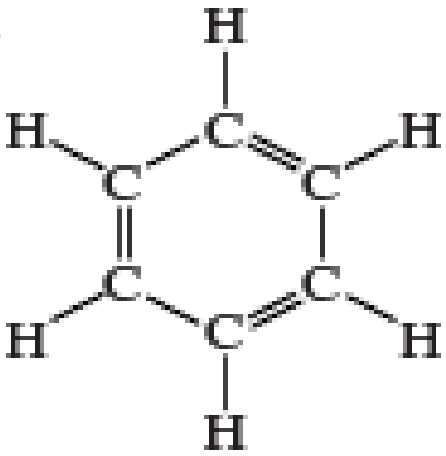
alkane



alkene

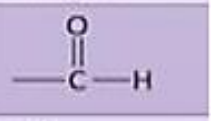
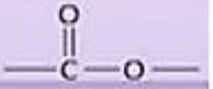
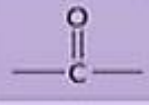
alkyne

aromatic hydrocarbons

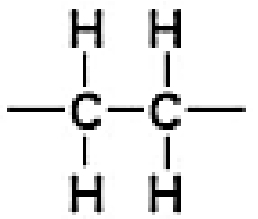


Functional Groups:-

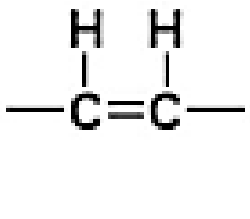
1. Functional groups are the components of organic molecules that are most commonly involved in chemical reactions.
2. The number and arrangement of functional groups give each molecule its unique properties.

Functional Group Name	Suffix Ending	Functional Group Structure
Alkane	-ane	C-H atoms
Alcohol	-ol	--OH
Alkene	-ene	C=C
Alkyne	-yne	HC≡CH
Aldehyde	-al	
Amine	-amine	--N--
Ether	-ether	--O--
Ester	-oate	
Ketone	-one	
Nitrile	-ile	—C≡N

Hydrocarbon Derivatives

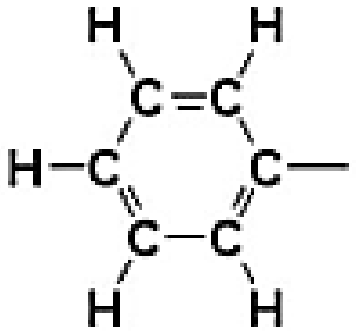


alkane

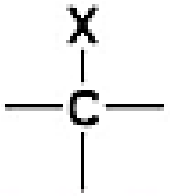


alkene

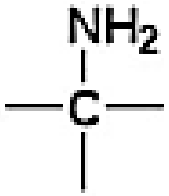
alkyne



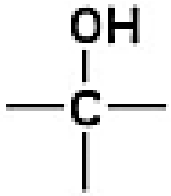
phenyl



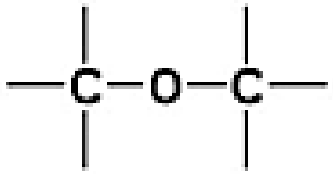
alkyl halide
(X = F, Cl, Br, I)



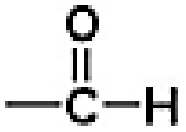
amine



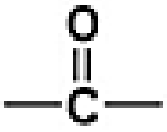
alcohol



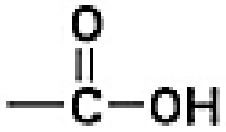
ether



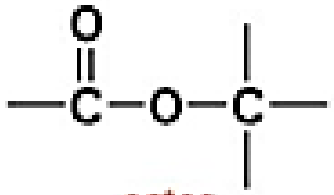
aldehyde



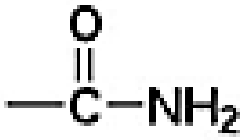
ketone



carboxylic acid



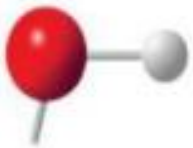
ester



amide

Hydroxyl

STRUCTURE



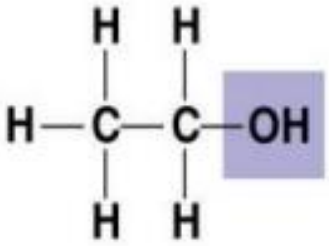
—OH

(may be written HO—)

NAME OF COMPOUND

Alcohols (Their specific names usually end in *-ol*.)

EXAMPLE



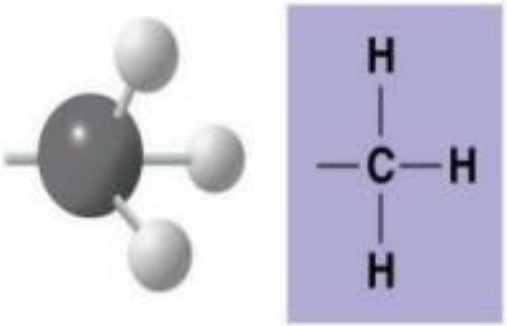
Ethanol

FUNCTIONAL PROPERTIES

- Is polar as a result of the electrons spending more time near the electronegative oxygen atom.
- Can form hydrogen bonds with water molecules, helping dissolve organic compounds such as sugars.

Methyl

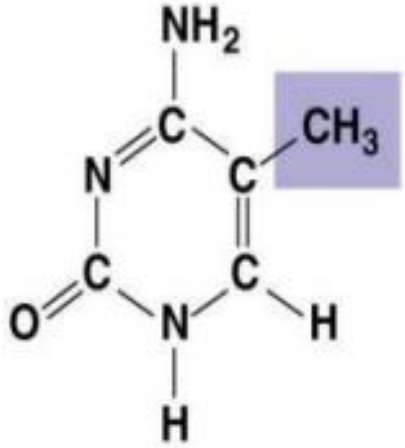
STRUCTURE



Methylated compounds

NAME OF COMPOUND

EXAMPLE



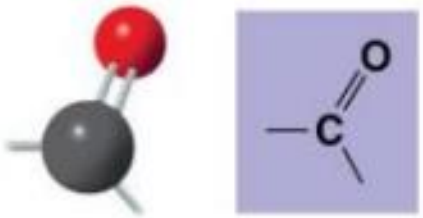
5-Methyl cytidine

- Addition of a methyl group to DNA, or to molecules bound to DNA, affects the expression of genes.
- Arrangement of methyl groups in male and female sex hormones affects their shape and function.

FUNCTIONAL PROPERTIES

Carbonyl

STRUCTURE

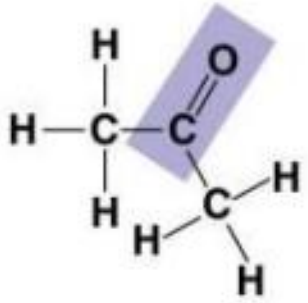


NAME OF COMPOUND

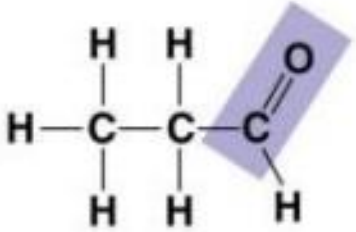
Ketones if the carbonyl group is within a carbon skeleton

Aldehydes if the carbonyl group is at the end of the carbon skeleton

EXAMPLE



Acetone

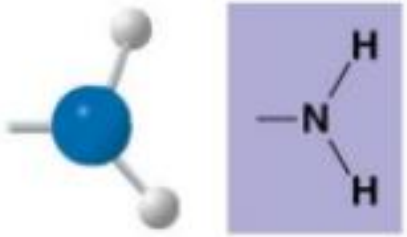


FUNCTIONAL PROPERTIES

- **A ketone and an aldehyde may be structural isomers with different properties, as is the case for acetone and propanal.**
- **Ketone and aldehyde groups are also found in sugars, giving rise to two major groups of sugars: ketoses (containing ketone groups) and aldoses (containing aldehyde**

Amino

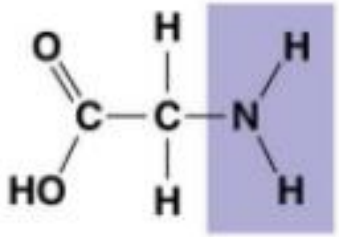
STRUCTURE



Amines

NAME OF COMPOUND

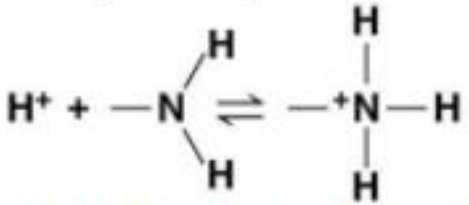
EXAMPLE



Glycine

FUNCTIONAL PROPERTIES

- Acts as a base; can pick up an H^+ from the surrounding solution (water, in living organisms):

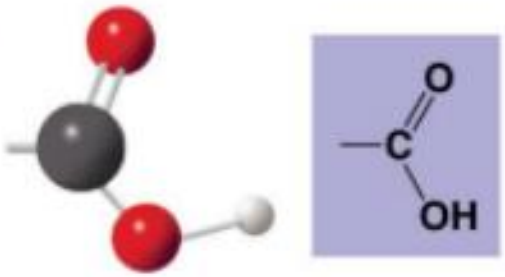


Nonionized Ionized

- Found in cells in the ionized form with a charge of 1+.

Carboxyl

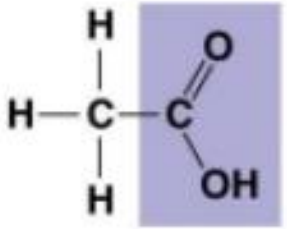
STRUCTURE



Carboxylic acids, or organic acids

NAME OF COMPOUND

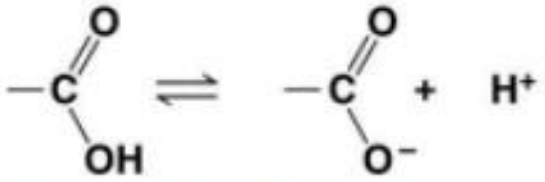
EXAMPLE



Acetic acid

FUNCTIONAL PROPERTIES

- **Acts as an acid; can donate an H^+ because the covalent bond between oxygen and hydrogen is so polar:**

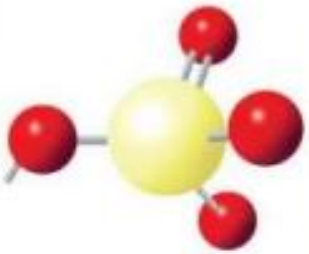


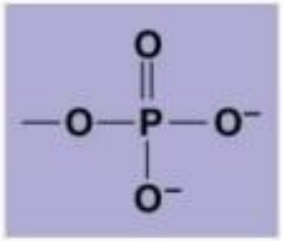
Nonionized **Ionized**

- **Found in cells in the ionized form with a charge of 1– and called a carboxylate ion.**

Phosphate

STRUCTURE

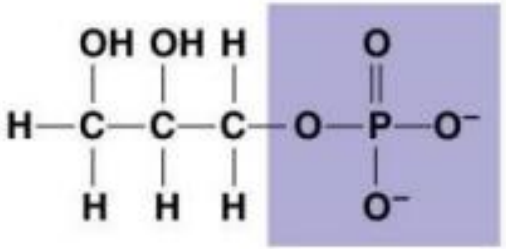




Organic phosphates

NAME OF COMPOUND

EXAMPLE



Glycerol phosphate

FUNCTIONAL PROPERTIES

- Contributes negative charge to the molecule of which it is a part (2– when at the end of a molecule, as at left; 1– when located internally in a chain of phosphates).
- Molecules containing phosphate groups have the potential to react with water, releasing energy.

Thank you