

# ORGANIC CHEMISTRY

What do you think of when you hear the word “Organic”?

Leaves	almonds	margarine
Plastic	steak	soap
Rubber	butter	vinegar
Diapers	vinyl siding	cotton
Wax	varnish	tupperware
Aspirin	nail polish remover	
Oil	saran wrap	milk

## So what does it mean to be “Organic”?

- Organic Chemistry is the study of compounds in which CARBON is the principal element.
- Carbon can form 4 covalent bonds
- Carbon can form single, double or triple bonds
- Carbon can bond to other elements, like O, F, Cl, N, producing polar molecules with higher boiling points
- Carbon can form chains, rings, spheres, sheets, tubes of many sizes.....

*....therefore.....*

*there are many many many many many many many many many many many*

**ORGANIC COMPOUNDS!**

## How are Organic Compounds Classified?

According to their "functional group"

- A recognizable combination of atoms in each molecule.
- Alkanes, Alkenes, Alkynes, Cyclic Hydrocarbons, Aromatics, Alcohols and more....
- Look for the functional group for naming the organic compound.

## HYDROCARBONS

the simplest of functional groups

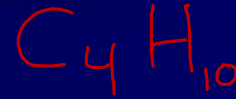
### Structure and Property

- Contain only C and H
- All hydrocarbons are nonpolar molecules, which results in low melting points and boiling points
- The longer the carbon chain, the higher its melting point and boiling point

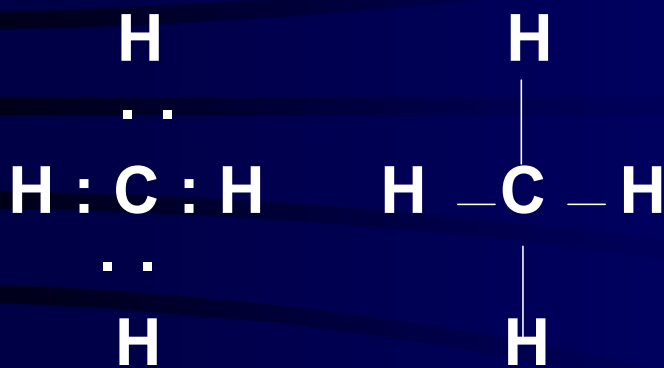
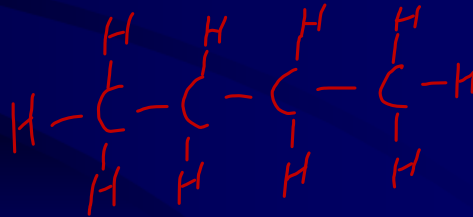
## Alkanes

- Saturated hydrocarbon (all single bonds)
- it has the maximum number of hydrogens bonded

- General formula:  $C_nH_{2n+2}$

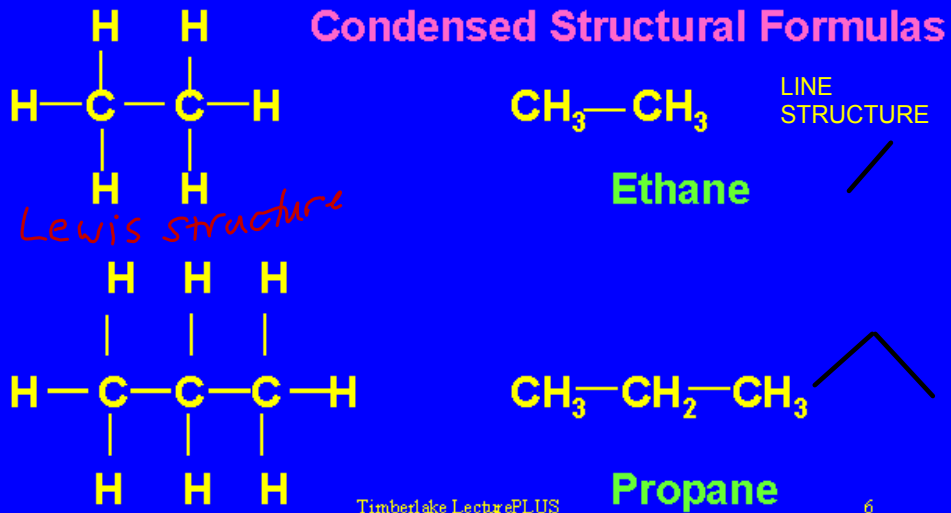


- Relatively UNREACTIVE because of the single bonds



CH<sub>4</sub> , methane

## More Alkanes



movie

## Alkenes

- Unsaturated hydrocarbon (double bond present)
- General formula:  $C_nH_{2n}$
- More reactive than alkanes...reactions take place at the double bond

## Alkenes

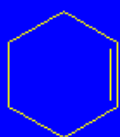
- Carbon-carbon double bonds
- Names end in **-ene**



ethene (ethylene)



propene (propylene)



cyclohexene

movie

- Alkynes
- Unsaturated hydrocarbon (triple bond present)
- General formula:  $C_nH_{2n-2}$
- Reactive like alkenes, with the reaction occurring at the triple bond

## Alkynes

- Carbon-carbon triple bonds
- Names end in -yne

$\text{HC}\equiv\text{CH}$                   ethyne(acetylene)

$\text{HC}\equiv\text{C}-\text{CH}_3$               propyne

Let's try a movie here



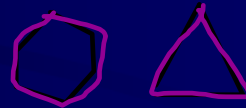
## Other terms.....

### Aliphatic

- Carbons are in a straight chain

### Cyclic

- Carbons form a ring



### Alkyl group

- When the hydrocarbon forms a branch group off of the main chain or ring.

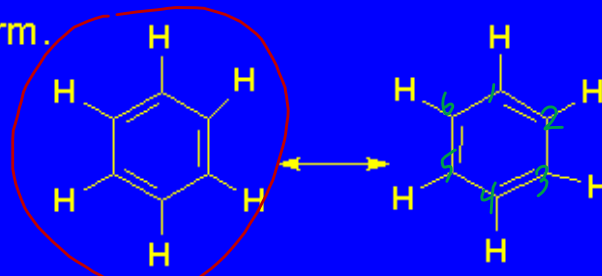
## Aromatics

- Special hydrocarbons
- Contain double bonds like alkenes, but react like alkanes
- Consist of alternating double bonds in a ring

## Aromatic Compounds and Benzene

- \* Aromatic compounds contain benzene.
- \* Benzene,  $C_6H_6$ , is represented as a six carbon ring with 3 double bonds.

Two possible can be drawn to show benzene in this form.



Timberlake LecturePLUS 1999

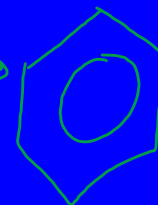
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## Benzene Structure

The structures for benzene can also be written as a single structure where the alternating double bonds are written as a circle within the ring.



Benzene structure



Timberlake LecturePLUS 1999

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# NAMING ORGANIC COMPOUNDS



## ORGANIC CHEMISTRY NOMENCLATURE

3

**PREFIX**

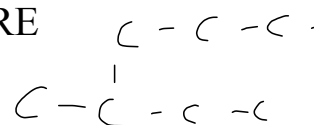
1

**ROOT**

2

**SUFFIX**

I.U.P.A.C  
ORGANIC CHEMISTRY NOMENCLATURE



# OF CARBONS IN THE  
PARENT (LONGEST) CHAIN

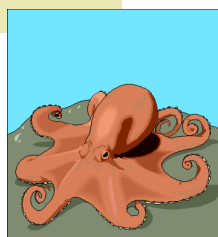
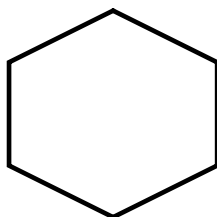
1-METH    2-ETH    3-PROP    4-BUT    5-PENT  
6-HEX    7-HEPT    8- OCT    9- NON    10- DEC  
11- UNDEC    12- DODEC

### Mnemonic for First Four Prefixes



First four prefixes

- Meth-      Monkeys
- Eth-        Eat
- Prop-      Peeled
- But-        Bananas



**Decade**  
**Decimal**  
**Decathlon**

## ORGANIC CHEMISTRY NOMENCLATURE



INDICATES THE TYPE OF  
BOND OR **FUNCTIONAL**  
**GROUP**

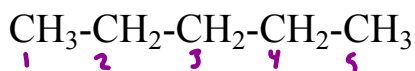
eg. alkanes -ane      alkenes- ene  
alkynes- yne      alcohols - ol  
ketones - one

(see handout)

\* rule 1: always start counting  
from side closest to  
functional group

eg.

alkane

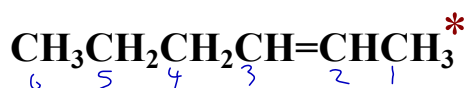


pentane

alkene

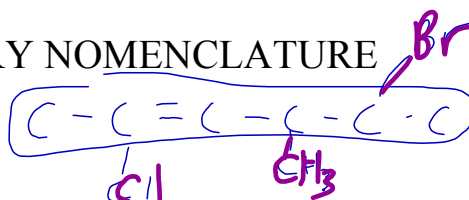


2-hexene



2-hexene

## ORGANIC CHEMISTRY NOMENCLATURE

**PREFIX****ROOT****SUFFIX**

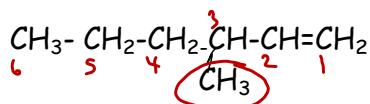
location of branch group (including carbon #)  
name of branch

halide branches: F- fluoro Cl- chloro Br- Bromo I- iodo

branch names come from carbon prefixes:

eg. branch of 1 carbon -methyl → branch  
 branch of 2 carbons- ethyl

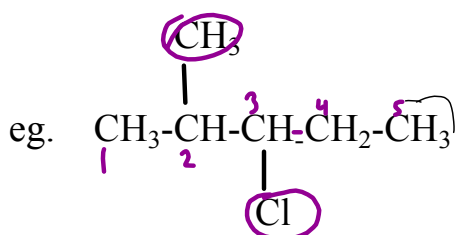
branch of benzene- phenyl



3- methyl hex-1-ene  
 (-) separates number  
 from letter

rule 2: if there is more  
 than one branch, name  
 them in alphabetical order

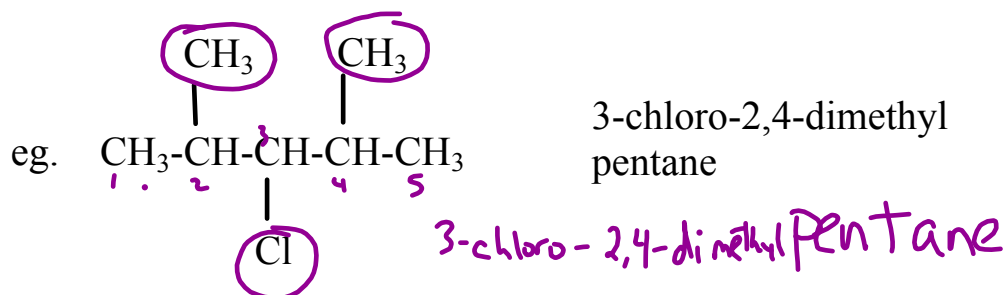
\* branches must be at  
 lowest carbon location  
 number.



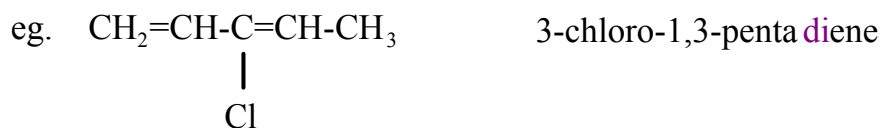
3-chloro-2-methylpentane

3-chloro-2-methylpentane

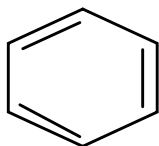
rule 3: If there is two of the same branch, make sure you put both locations and use a prefix:  
2- di 3- tri 4- tetra



**rule 4: If there is more than one functional group, you need to use prefixes before naming the suffix**

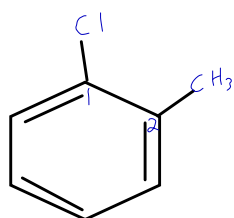
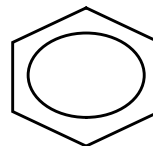


naming benzene rings

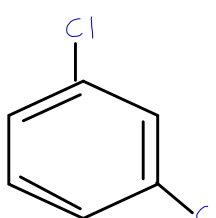


benzene

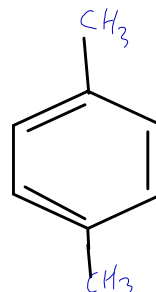
or



1,2 or "ortho"  
1-chloro-2-methylbenzene  
ortho chloromethylbenzene  
o-chloromethylbenzene



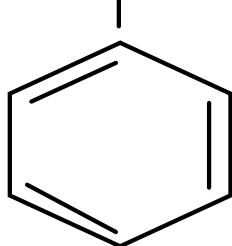
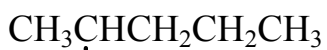
1,3 or "meta"  
m-dichlorobenzene



1,4 or para  
p-dimethylbenzene

Pg 14 # 1 P. 17 1,2,4  
21 # 1,2  
30 # 1,2

Benzene as a branch on a chain: "phenyl"





try these from the text:

pg. 14 # 1 # 2 ,4

pg. 21 #1,2

pg. 27 #2,4,5

30 #1,2

pg. 31 # 1,2