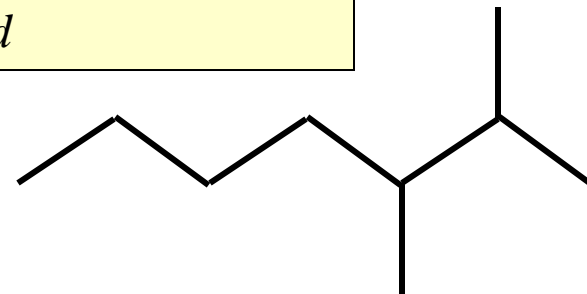
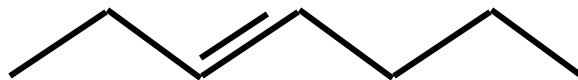
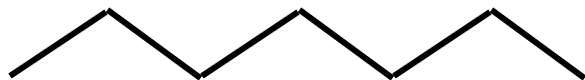


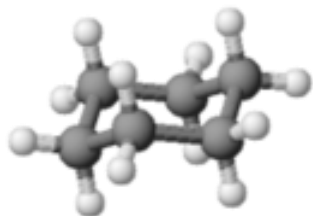
Paolo Sarti 2011  
 Department of Biochemistry  
 Sapienza

# Organic compounds classification & structure

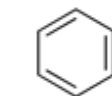
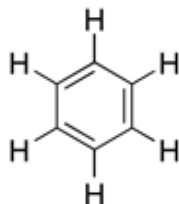
**Acyclic** → open chains, branched or not, saturated or insaturated



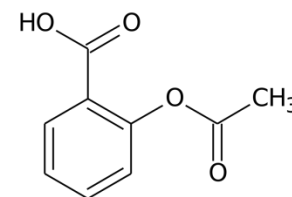
**Carbocyclic** → C rings: *a) simple (ring(s)) b) complex (ring(s) + side chain(s)).*



cyclohexane

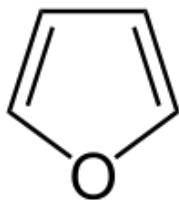


benzene

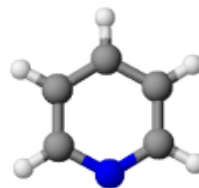
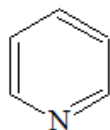


Acétyl salicylic acid

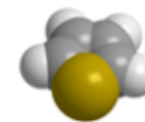
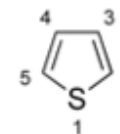
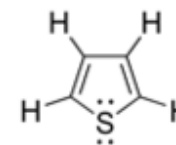
**Heterocyclic** → C rings including 1 or more hetero-atoms (O,N,S...)



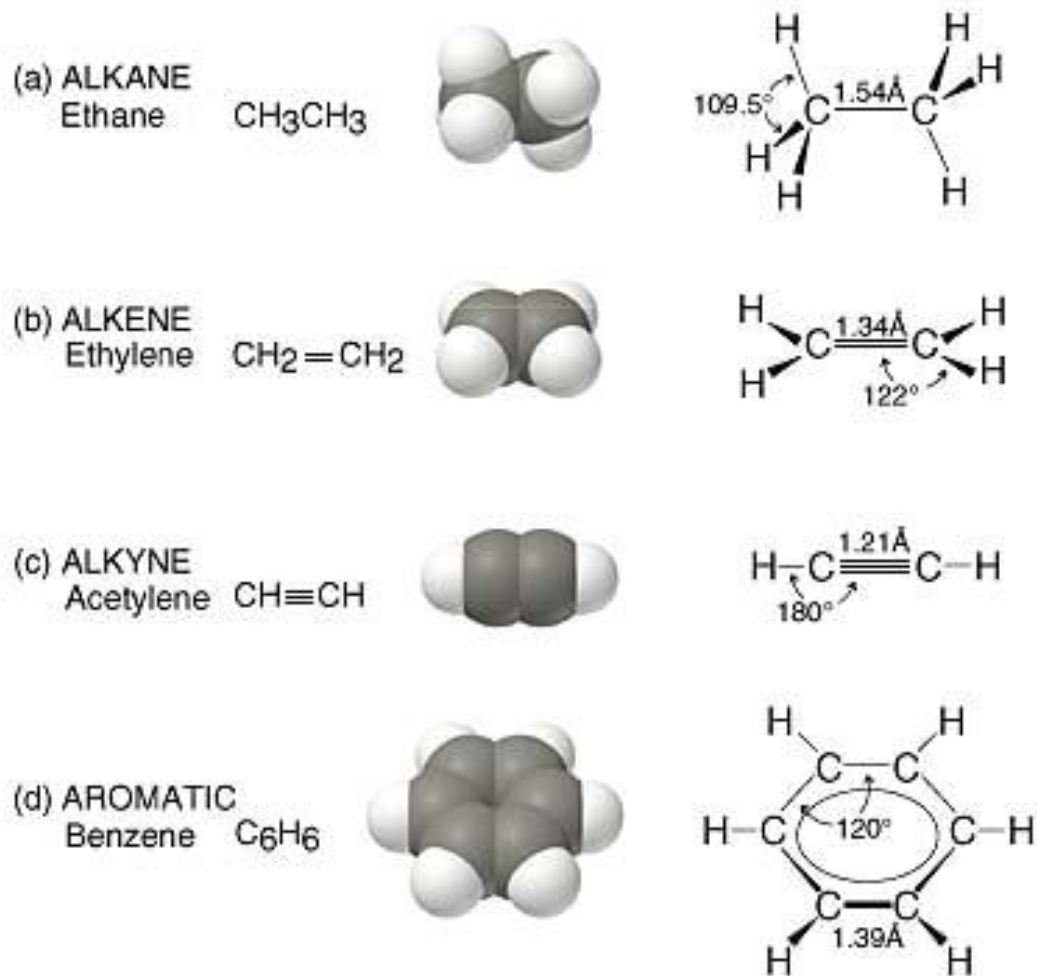
furan



pyridine



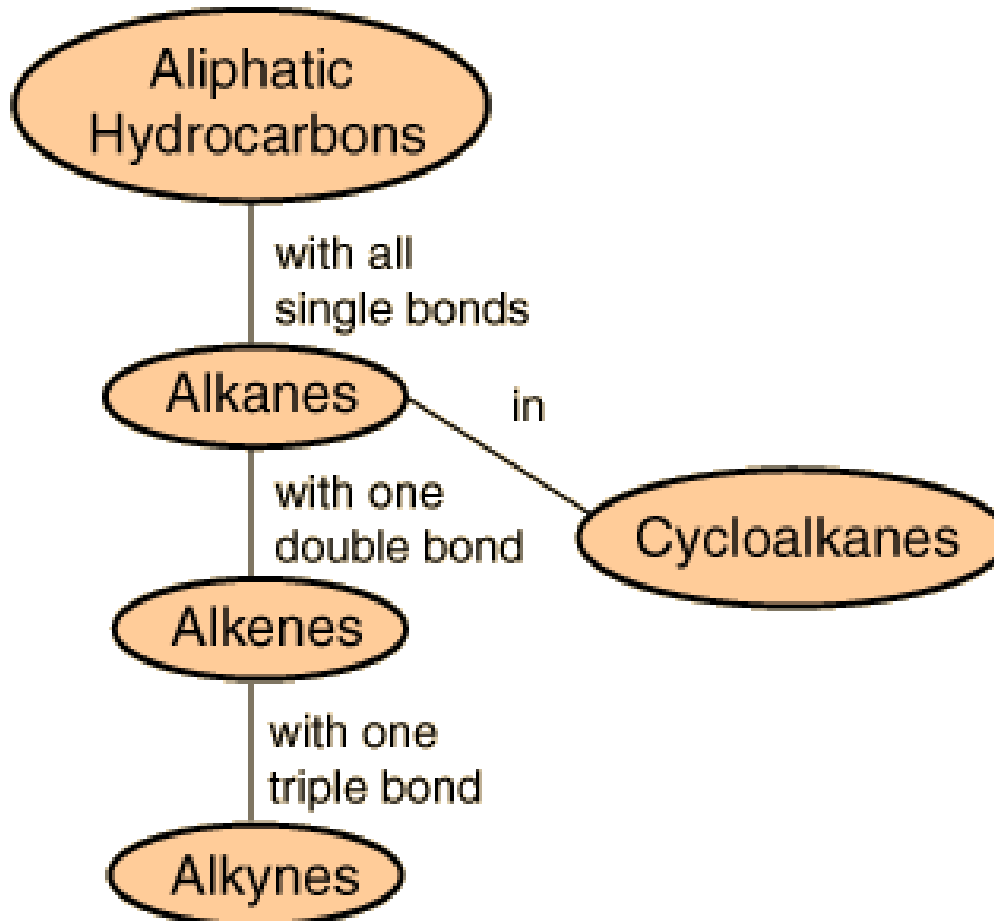
thiophene

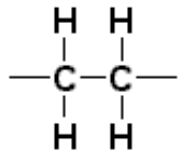


## Common carbon bonds

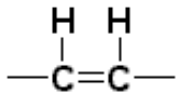
<i>bond</i>	<i>length (Å)</i>	<i>Energy (strength)</i>
Simple ( $\sigma$ ) C-C	1,53	88 kcal/mole
Simple ( $\sigma$ ) C-H	1,10	104 kcal/mole
Double ( $\sigma\pi$ ) C-C	1,34	146 kcal/mole
Triple ( $\sigma+\pi_1+\pi_2$ ) C-C	1,21	198 kcal/mole

# Aliphatic hydrocarbons

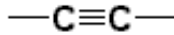




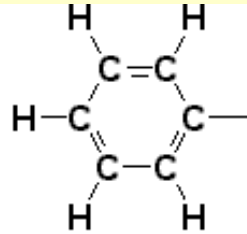
alkane



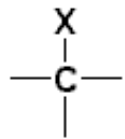
alkene



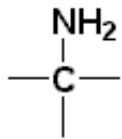
alkyne



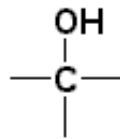
phenyl



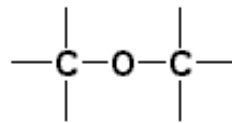
alkyl halide  
(X = F, Cl, Br, I)



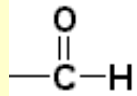
amine



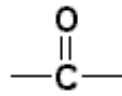
alcohol



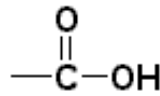
ether



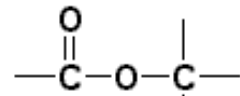
aldehyde



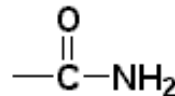
ketone










carboxylic acid



ester



amide

Structure	Group name	Major molecules having the group
$-\text{O}-\text{H}$ 	<b>Hydroxyl</b>	Found in carbohydrates and many other cellular compounds, <b>alcohols</b>
$\begin{array}{c} \text{O} \\    \\ -\text{C} \\   \\ \text{H} \end{array}$ 	<b>Aldehyde</b>	Found in aldo- type sugars
$\begin{array}{c} \text{O} \\    \\ \text{C} \\ / \quad \backslash \end{array}$ 	<b>Ketone</b>	Found in keto- type sugars
$\begin{array}{c} \text{O} \\    \\ -\text{C} \\   \\ \text{OH} \end{array}$ 	<b>Carboxyl</b>	Found in organic acids such as amino acids and fatty acids.
$\begin{array}{c} \text{H} \\   \\ -\text{N} \\   \\ \text{H} \end{array}$ 	<b>Amine</b>	Found in amino acids, proteins, and other N-containing compounds
$\begin{array}{c} \text{OH} \\   \\ -\text{O}-\text{P}=\text{O} \\   \\ \text{OH} \end{array}$ 	<b>Phosphate</b>	Found in nucleic acids (DNA, RNA), ADP, ATP, phospholipids
$-\text{S}-\text{H}$ 	<b>Sulfhydryl</b>	Found in the amino acid cysteine and thus in most proteins.

# Simple Organic Compounds & Functional Groups - (Part 1)

Functional group	Class of compounds	Structural formula	Example	Ball-and-stick model
Hydroxyl -OH	Alcohols	R-OH	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{OH} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ Ethanol	
Carbonyl -CHO	Aldehydes	R-C(=O)H	$  \begin{array}{c}  \text{H} \quad \text{O} \\    \quad    \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \\  \text{H}  \end{array}  $ Acetaldehyde	
Carbonyl CO	Ketones	R-C(=O)-R	$  \begin{array}{c}  \text{H} \quad \text{O} \quad \text{H} \\    \quad    \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ Acetone	
Carboxyl -COOH	Carboxylic acids	R-C(=O)OH	$  \begin{array}{c}  \text{H} \quad \text{O} \\    \quad    \\  \text{H}-\text{C}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ Acetic acid	



SBS1513

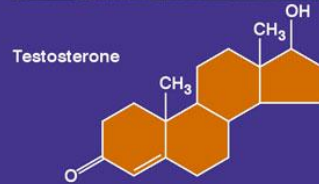
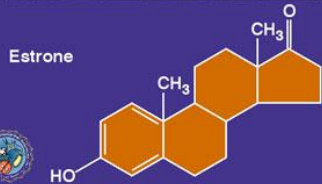
# Simple Organic Compounds & Functional Groups - (Part 2)

Functional group	Class of compounds	Structural formula	Example	Ball-and-stick model
Amino -NH <sub>2</sub>	Amines		 Methylamine	
Phosphate -OPO <sub>3</sub> <sup>2-</sup>	Organic phosphates		 3-Phosphoglyceric acid	
Sulfhydryl -SH	Thiols		 Mercaptoethanol	



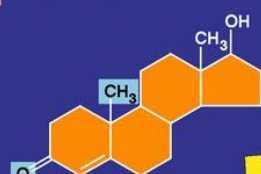
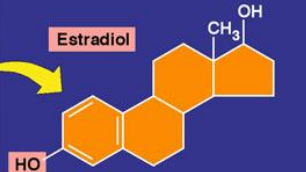


## A Comparison of Functional groups of female (estrone) and male (testosterone) sex hormones

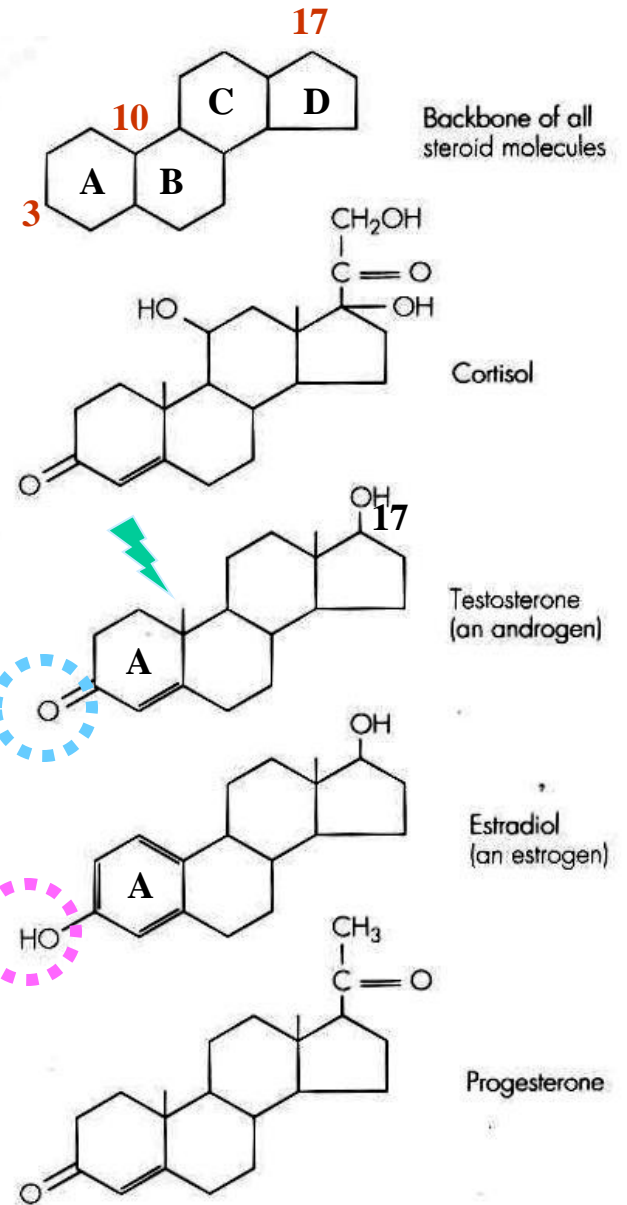


SBS0963

## A Comparison of Functional Groups of Female (estradiol) and (testosterone) Sex Hormones



SBS1096

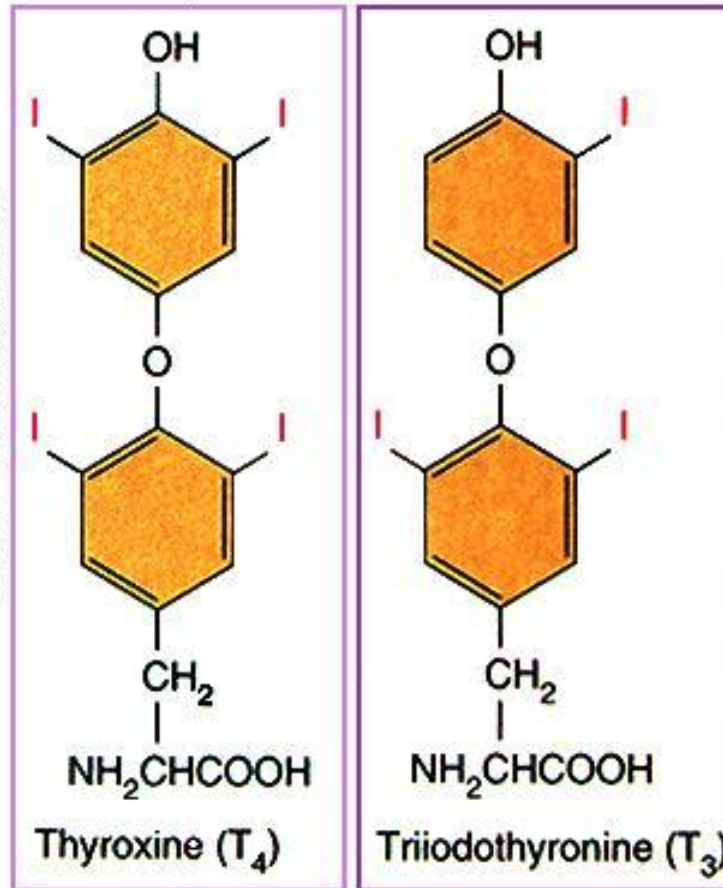


**Figure 3.24 Steroid hormones**

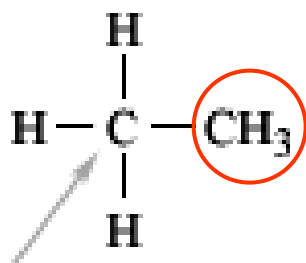
Note the similarity between the sex hormones testosterone and estradiol.

## Thyroxine Hormone

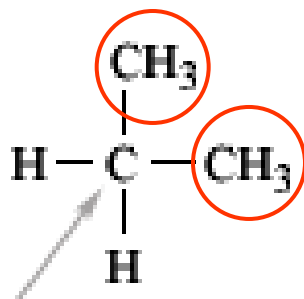
Hole's Human Anatomy and Physiology,  
7th edition, by Shier, et al. copyright  
©1996 TM Higher Education Group, Inc.



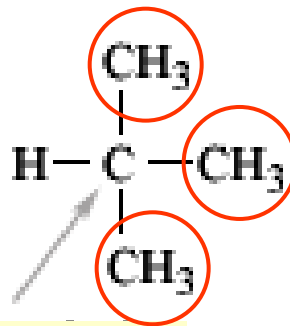
# Watch the carbon supporting the functional group(s)... classification:



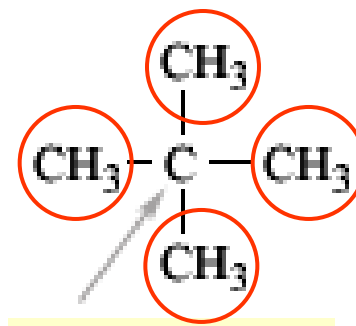
*C - primary*



*C - secondary*



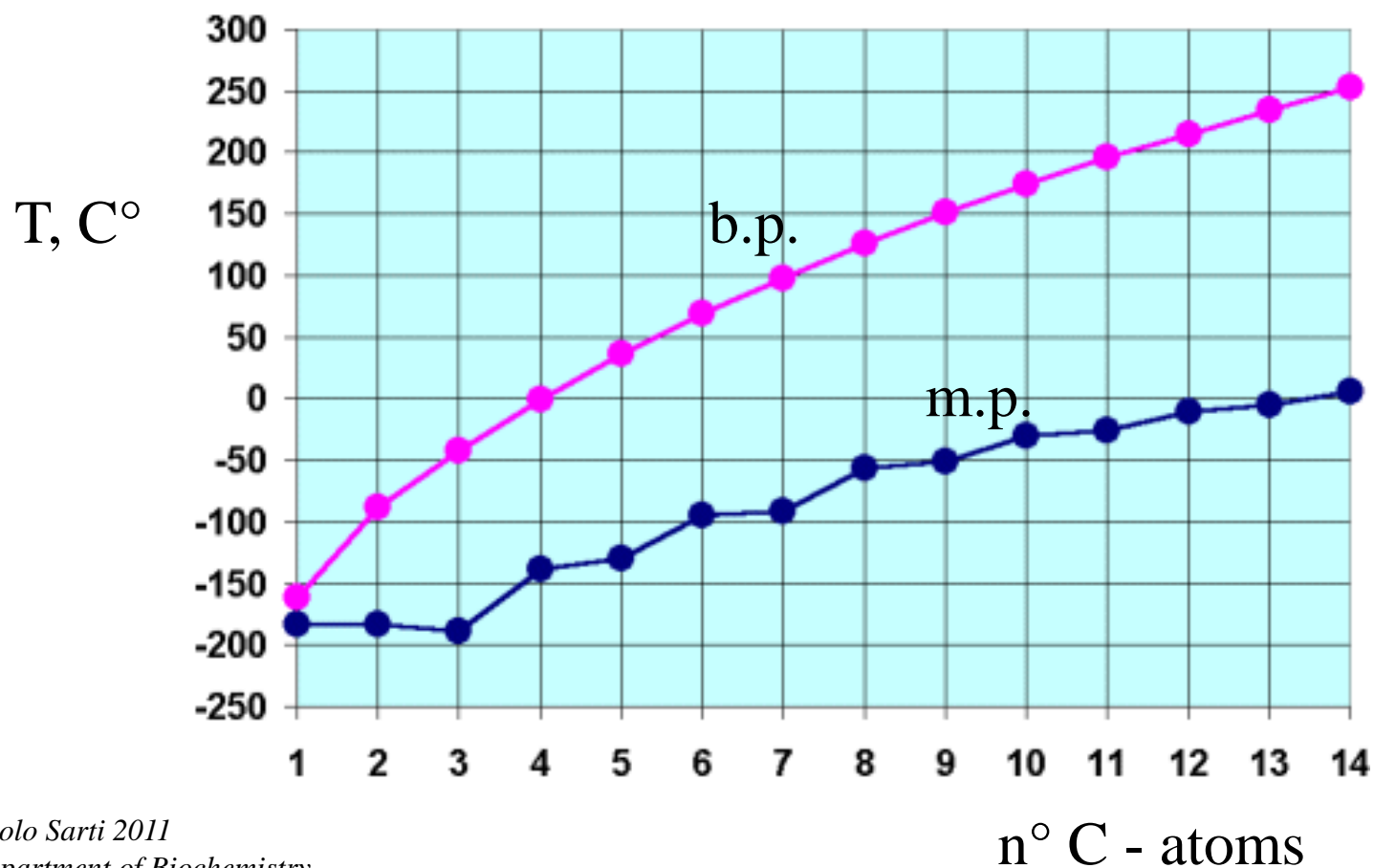
*C - tertiary*



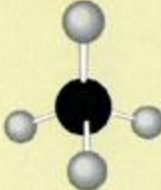

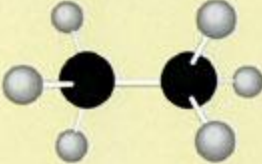

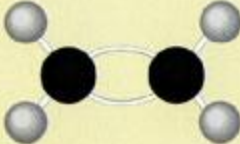

*C - quaternary*

Physical properties:

- a) Apolar
- b) Density < H<sub>2</sub>O
- c) Boiling p. (rather low...)



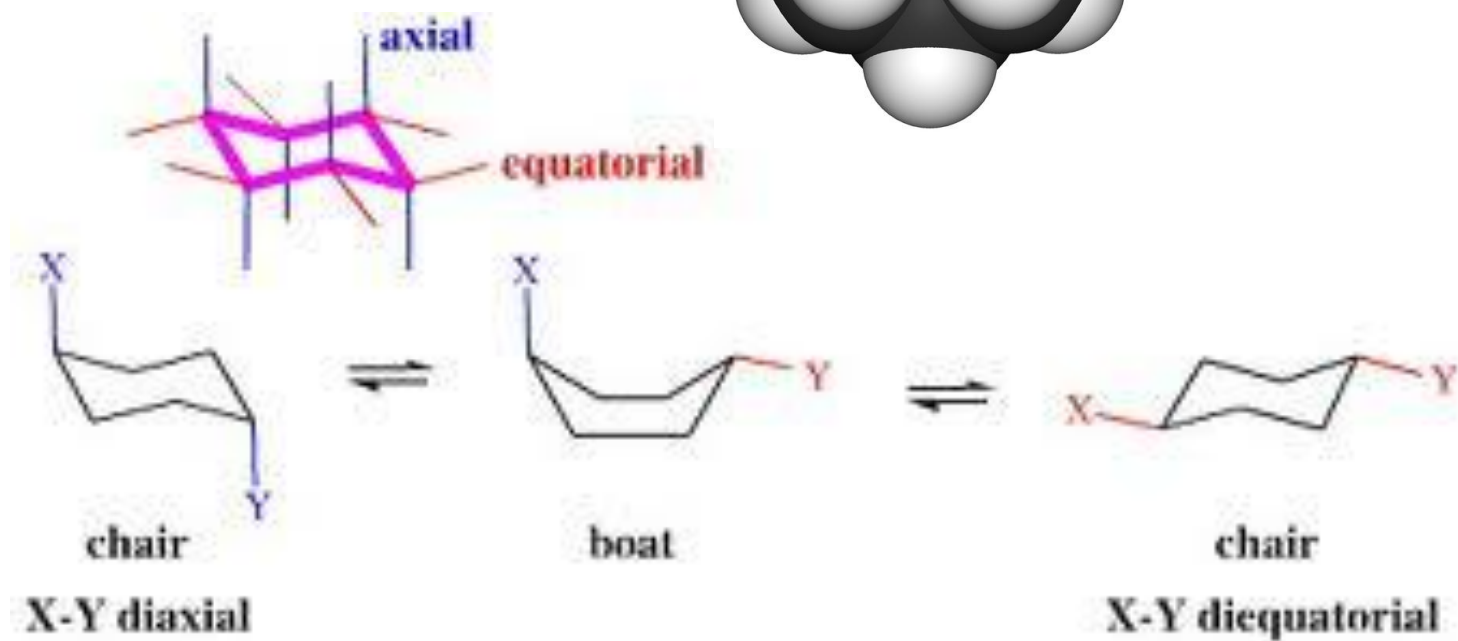
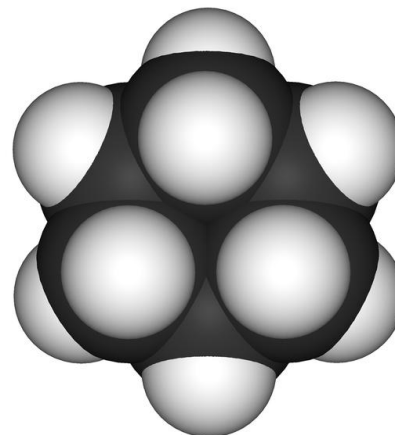
# Shapes of Three Simple Organic Molecules

	MOLECULAR FORMULA	STRUCTURAL FORMULA	BALL-AND-STICK MODEL	SPACE-FILLING MODEL
Methane	CH <sub>4</sub>	<pre>       H         H — C — H               H           </pre>		
Ethane	C <sub>2</sub> H <sub>6</sub>	<pre>       H   H             H — C — C — H                   H   H           </pre>		
Ethene (ethylene)	C <sub>2</sub> H <sub>4</sub>	<pre>       H   C   H        \ // \         C = C        // \ /       H   C   H           </pre>		

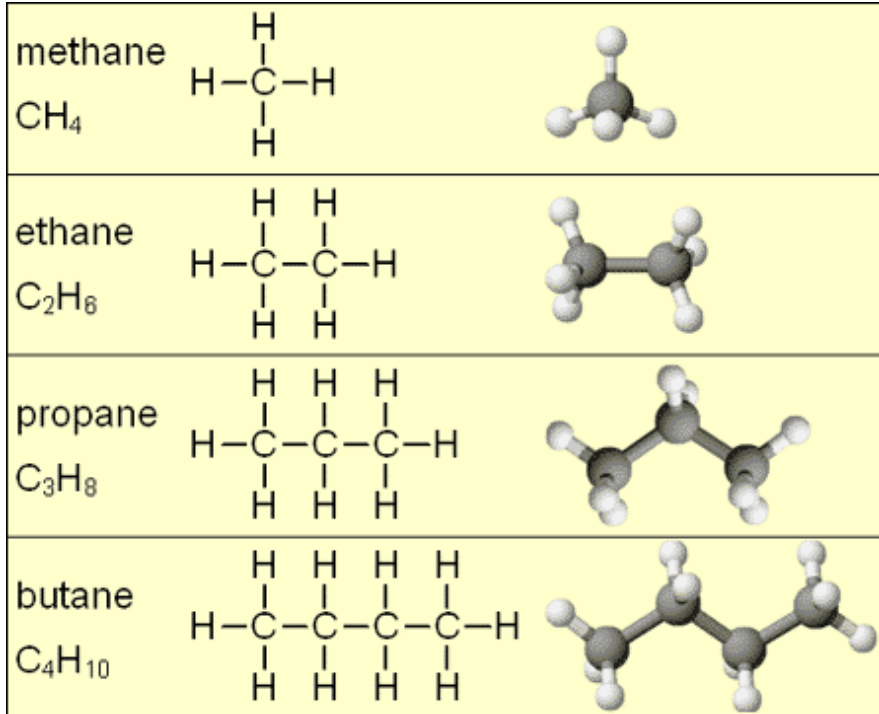


SBS1524

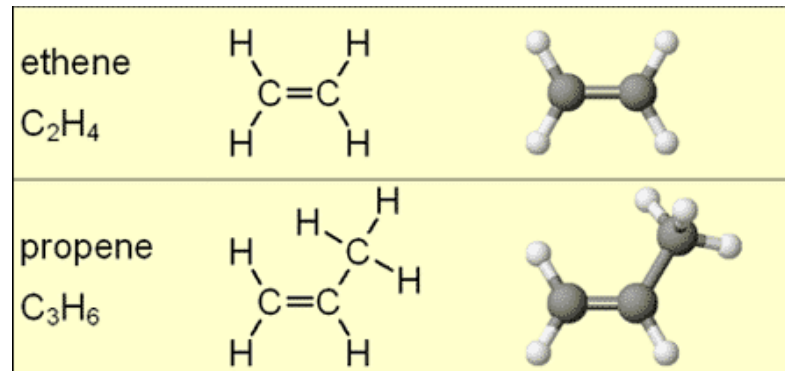
# Cyclohexane



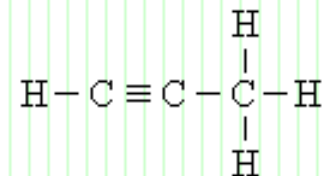
## Alkanes



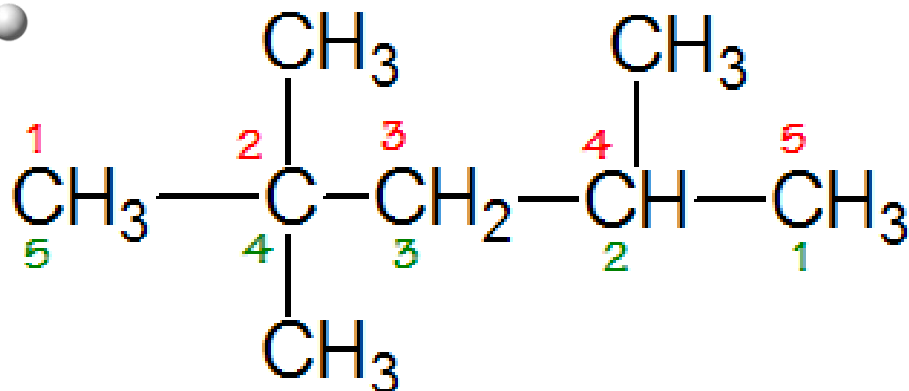
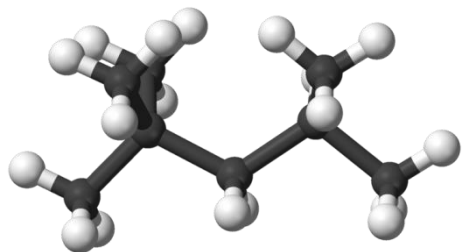
## Alkenes



## Alkynes



# Nomenclature - I.U.P.A.C



2,2,4 trimethyl-pentane (iso-octane)

From left to right: 2,2,4 --> yes !

from right to left : 2,4,4 --> no !