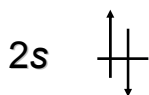
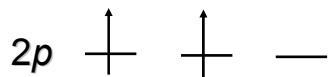
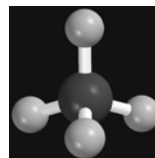


Introducción a la Química Orgánica

F. G. Calvo-Flores

Introducción

Configuración electrónica del carbono



F. G. Calvo-Flores

3

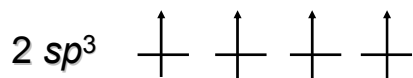
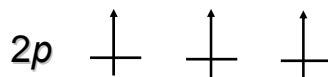
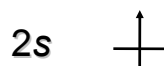
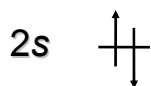
Hibridaciones del carbono

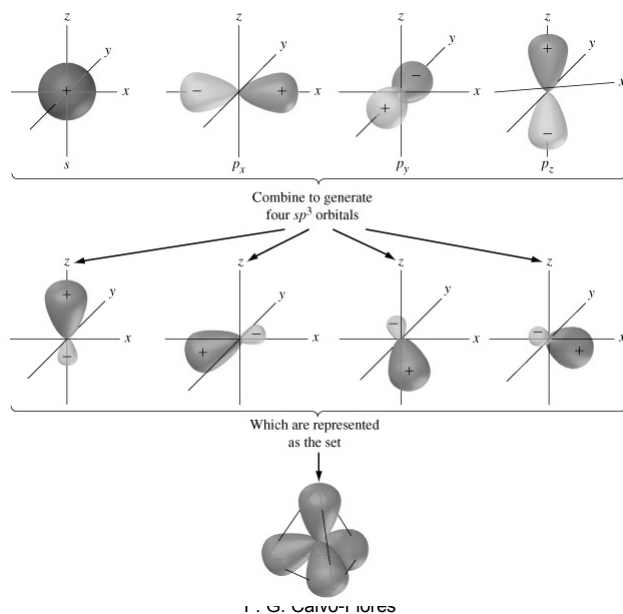
- Concepto de hibridación
- Tipos de hibridación:
 - sp^3
 - sp^2
 - sp

F. G. Calvo-Flores

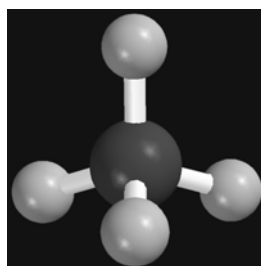
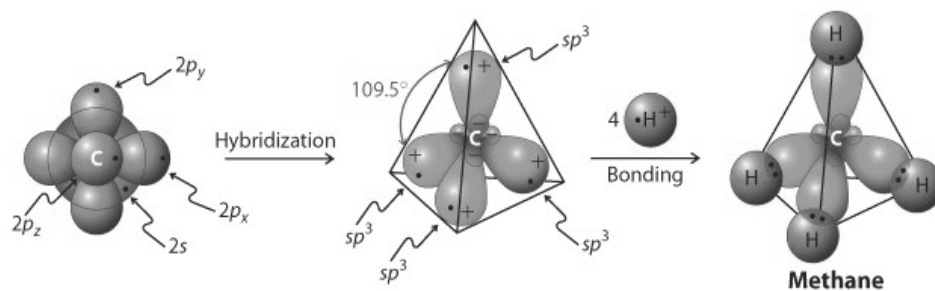
4

Hibridación sp^3



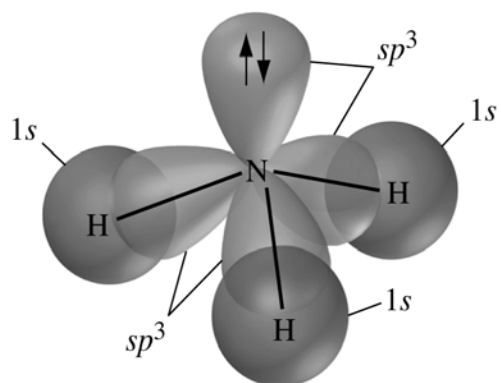
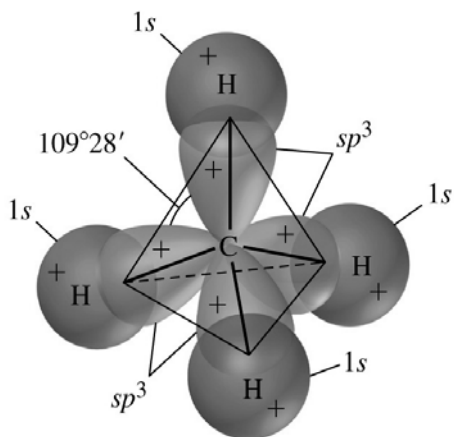
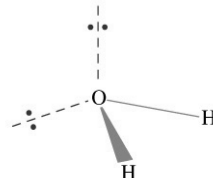
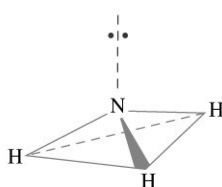
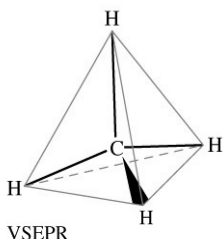


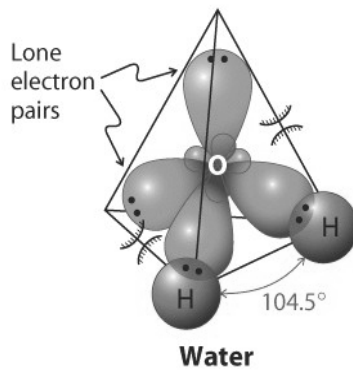
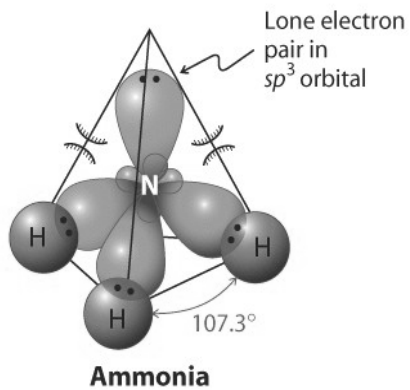
7



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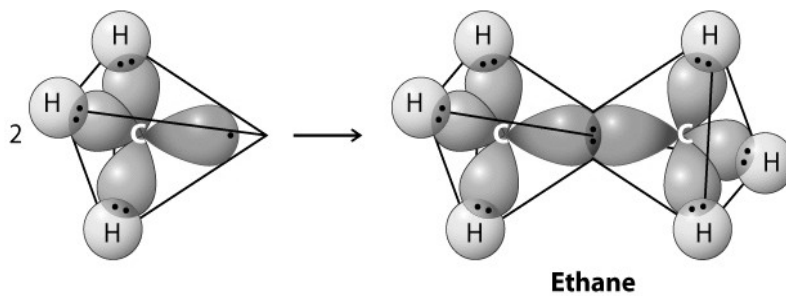
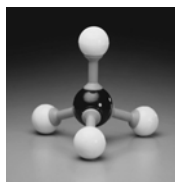
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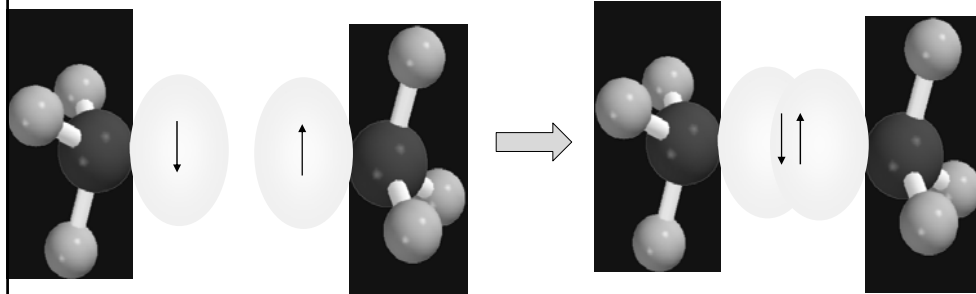
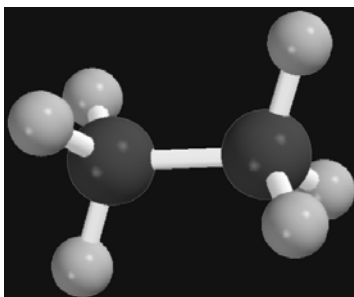
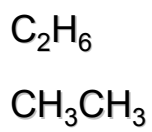
F. G. Calvo-Flores

11



F. G. Calvo-Flores

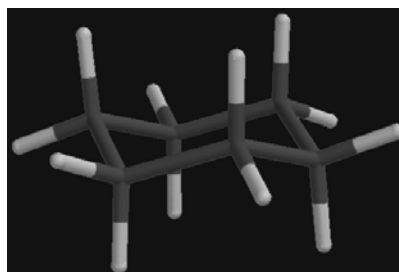
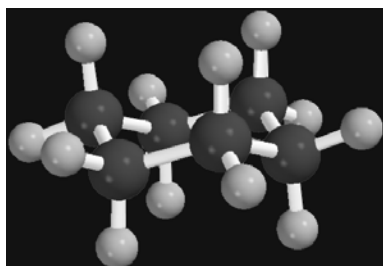
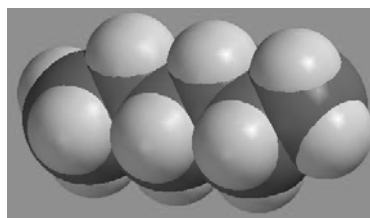
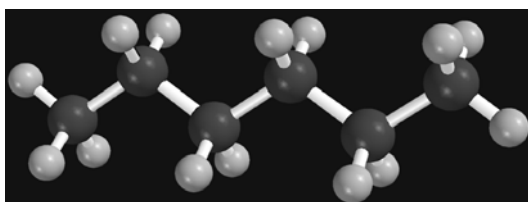
12



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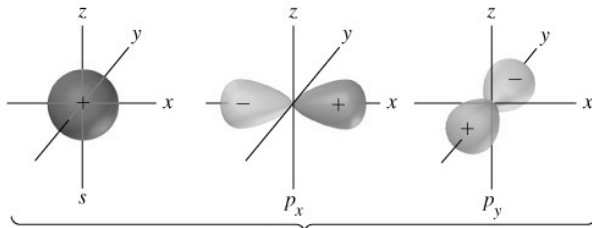
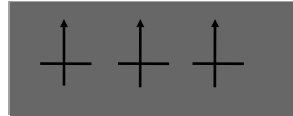
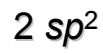
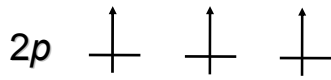
Cadenas y ciclos



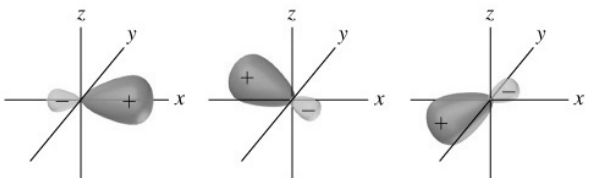
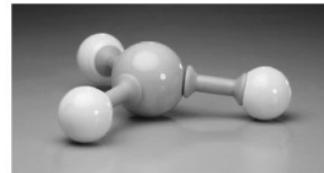
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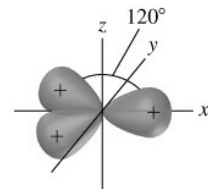
Hibridación sp^2

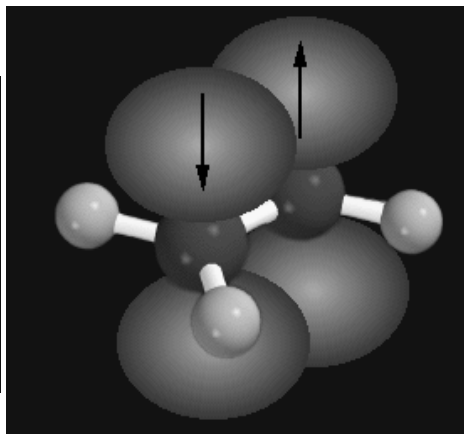
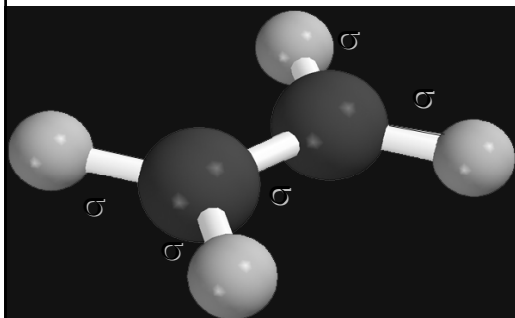
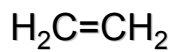


Combine to generate
three sp^2 orbitals



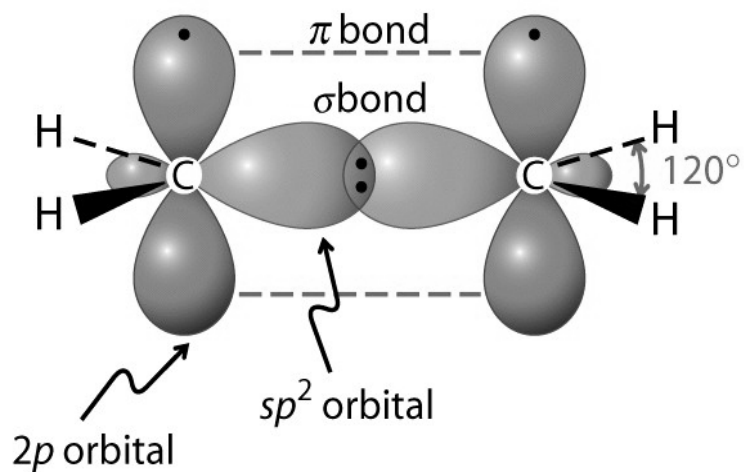
Which are
represented
as the set





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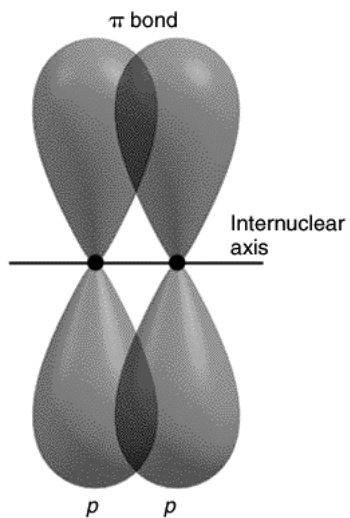
17



Ethene

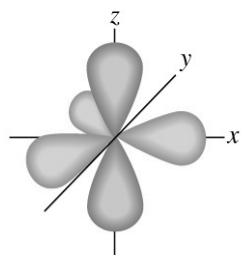
F. G. Calvo-Flores

18

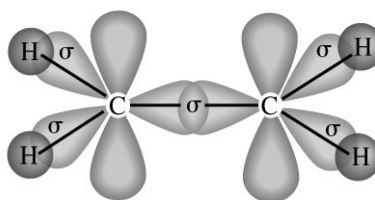


F. G. Calvo-Flores

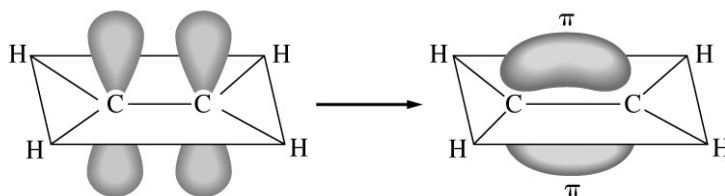
19



The set of orbitals $sp^2 + p$



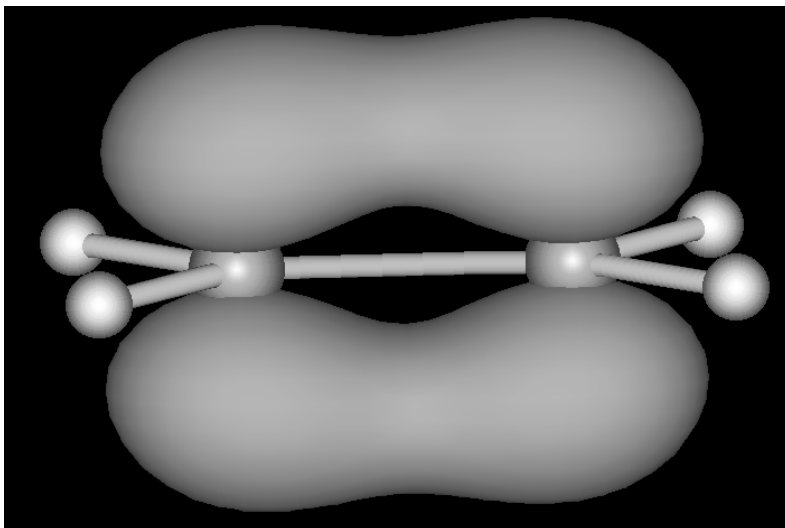
Sigma (σ) bonds



Overlap of p orbitals leading to pi (π) bond

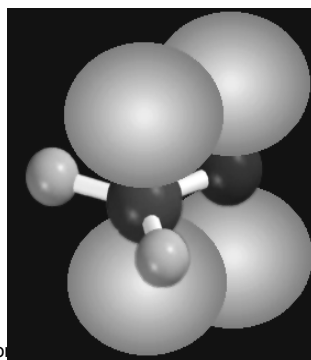
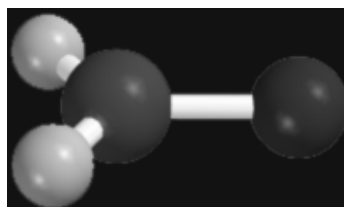
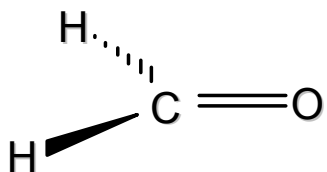
F. G. Calvo-Flores

20



F. G. Calvo-Flores

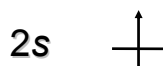
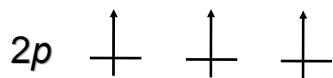
21



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Hibridación sp



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sp hybrid orbitals - 3



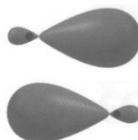
s orbital



p orbital



hybridize

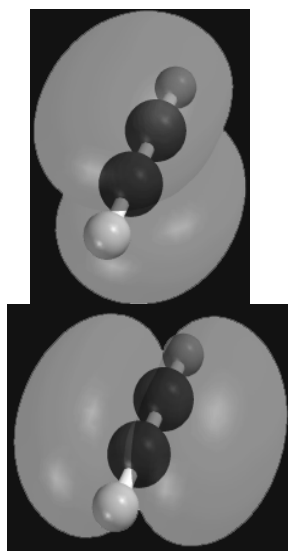
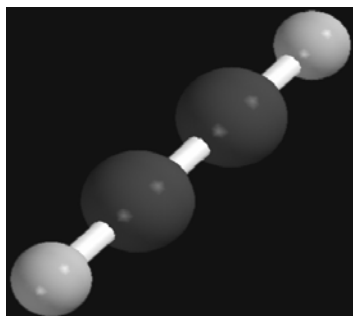
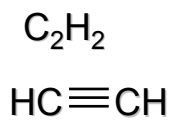


Two sp hybrid orbitals



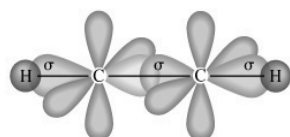
sp hybrid orbitals shown together
(large lobes only)

24

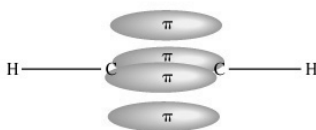


F. G. Calvo-Flores

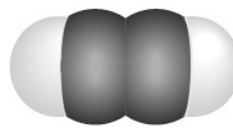
25



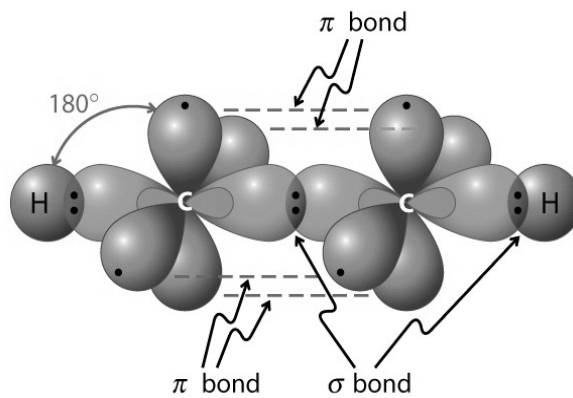
Formation of σ bonds



Formation of π bonds

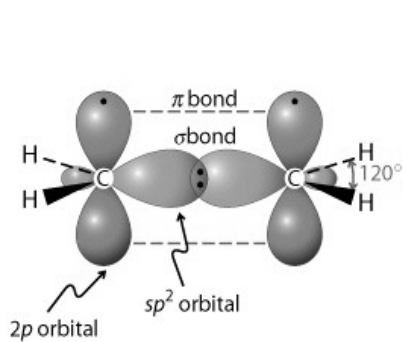


Space-filling model

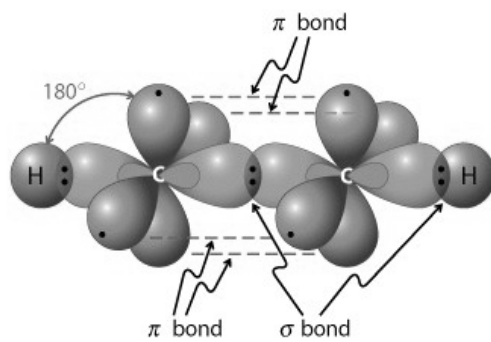


Ethyne

26



Ethene



Ethyne

Posibilidad de formación de enlaces

■ Con hibridación sp^3

■ -

■ Con hibridación sp^2

■ -

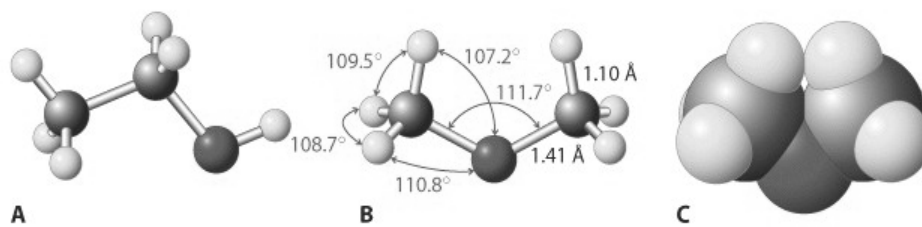
■ Con hibridación sp

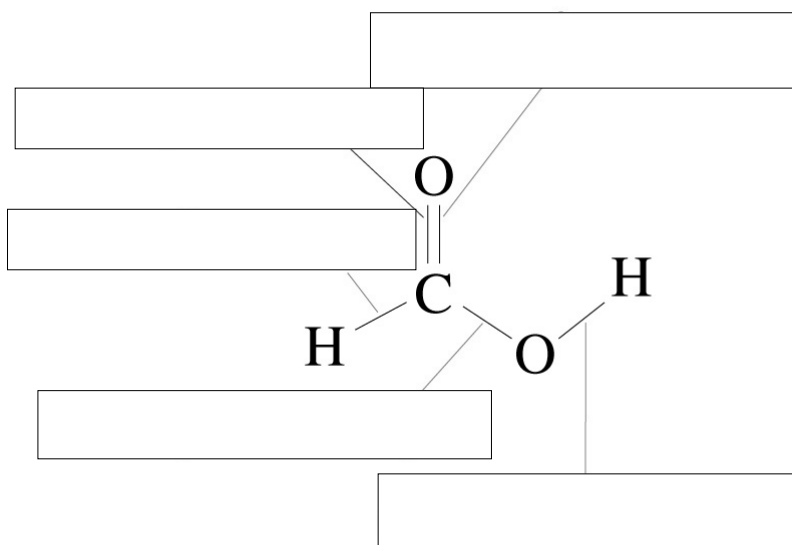
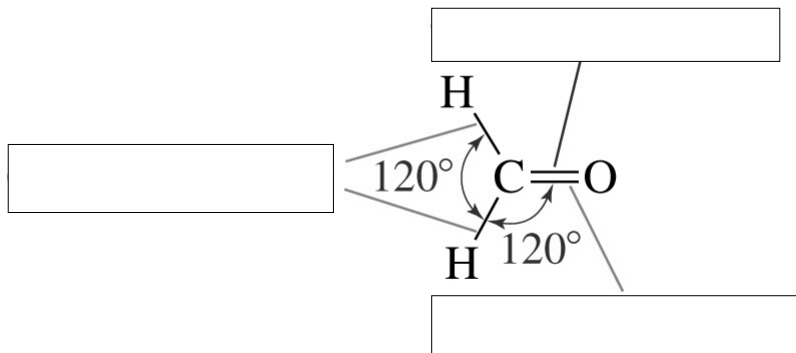
■ -

sp^3 :

• **sp^2 :**

• **sp :**



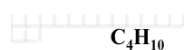


Formulación

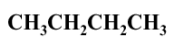
Fórmula empírica:

Fórmula molecular:

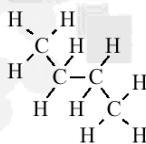
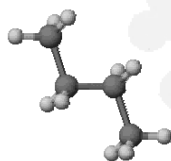
Fórmula estructural:



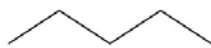
Molecular formula



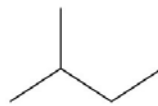
Condensed structure



"line" or structural drawing



(1)



(2)

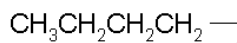


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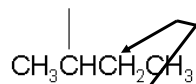
F. G. Calvo-Flores

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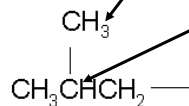
Carbonos primarios:



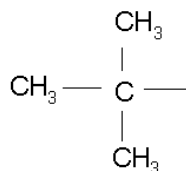
Carbonos secundarios:



Carbonos terciarios:



Carbonos Cuaternarios:



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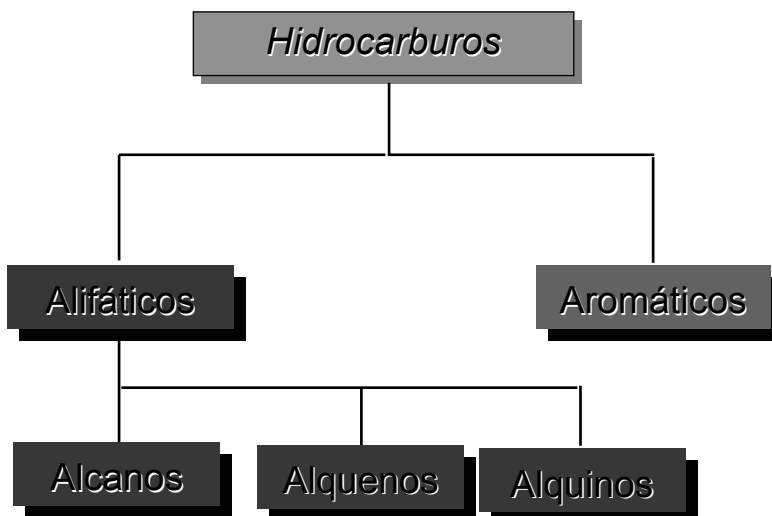
36

Concepto de grupo funcional

Grupo funcional:

Serie homóloga:

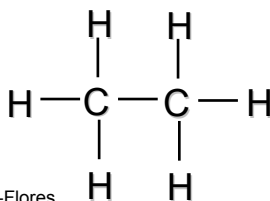
Clasificación de hidrocarburos



Hidrocarburos

Alifáticos

Alcanos



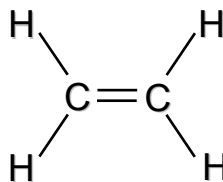
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Hidrocarburos

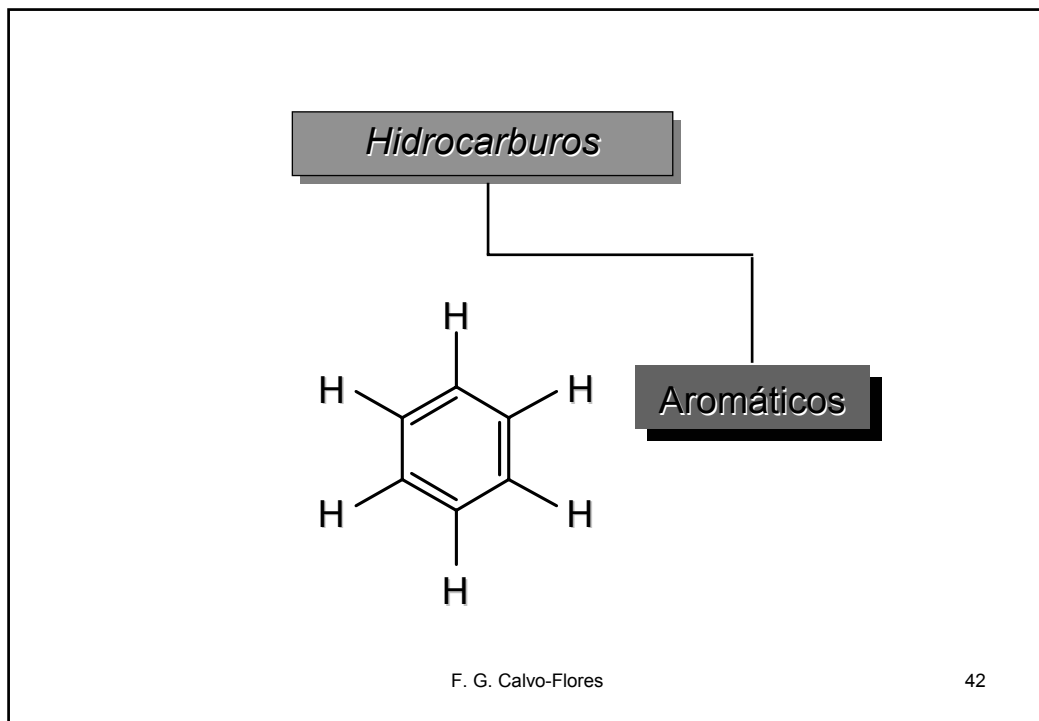
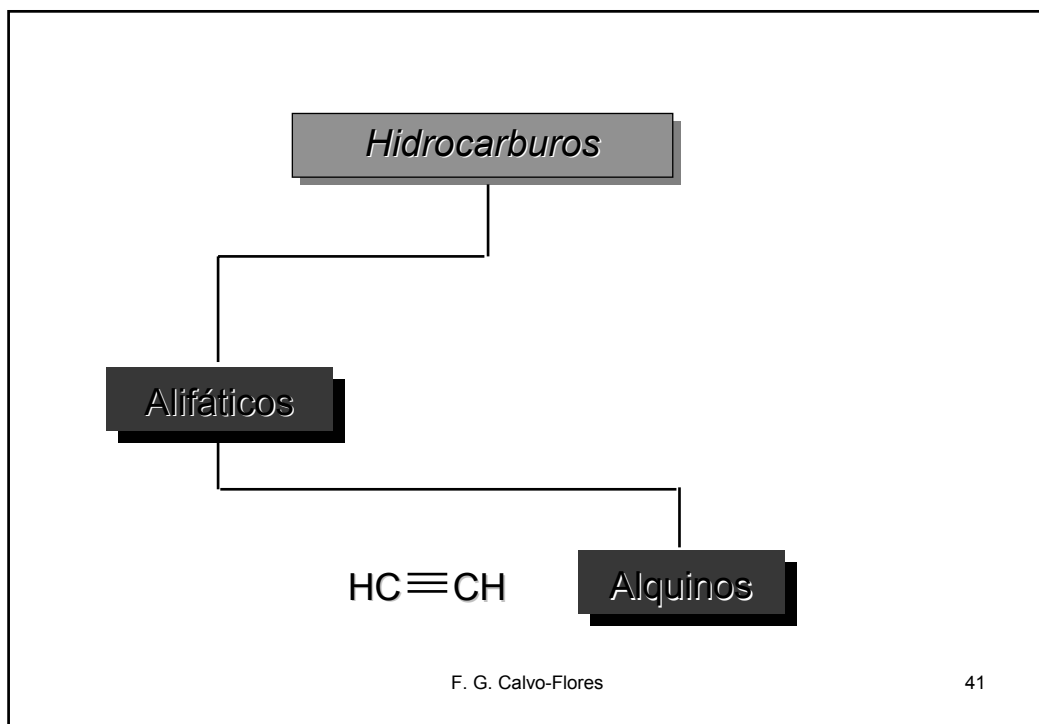
Alifáticos

Alquenos

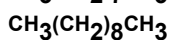
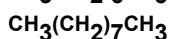
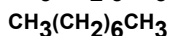
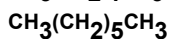
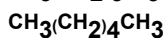
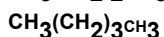
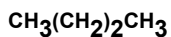
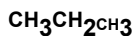
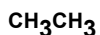


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Nomenclatura alcanos y cicloalcanos



metano: un átomo de carbono

etano: dos átomos de carbono

propano: tres átomos de carbono

butano: cuatro átomos de carbono

pentano: cinco átomos de carbono

hexano: seis átomos de carbono

heptano: siete átomos de carbono

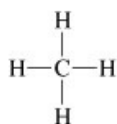
octano: ocho átomos de carbono

nonano: nueve átomos de carbono

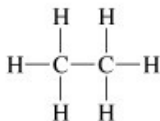
decano: diez átomos de carbono

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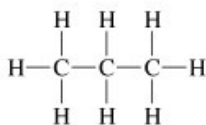
43



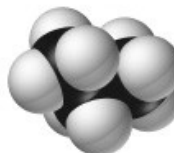
(a) Methane



(b) Ethane



(c) Propane



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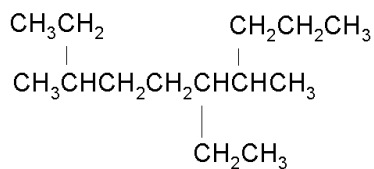
44

Nomenclatura de Radicales

$\text{CH}_3\text{-}$	metilo
$\text{CH}_3\text{CH}_2\text{-}$	etilo
$\text{CH}_3\text{CH}_2\text{CH}_2\text{-}$	propilo
$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{-}$	butilo
$\text{CH}_3(\text{CH}_2)_3\text{CH}_2\text{-}$	pentilo
$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{-}$	butilo
$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{-}$	butilo
$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{-}$	butilo
$\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{-}$	butilo

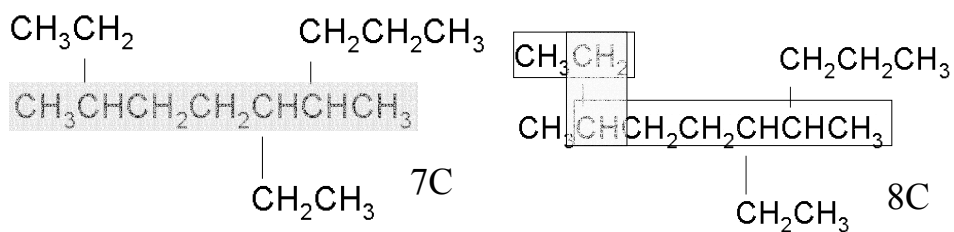
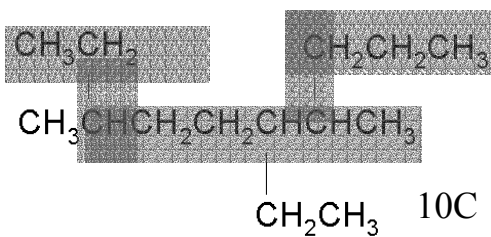
Alcanos y cicloalcanos ramificados

ELECCIÓN DE LA CADENA PRINCIPAL



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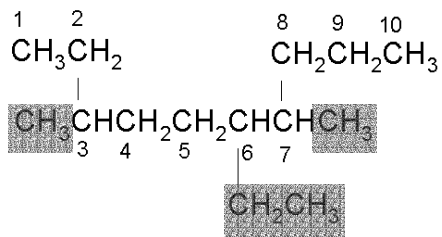


F. G. Calvo-Flores

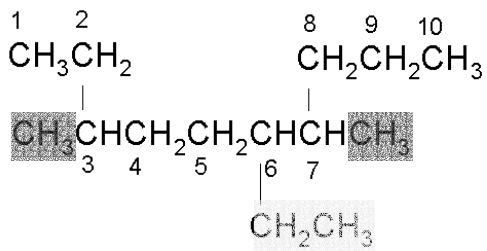
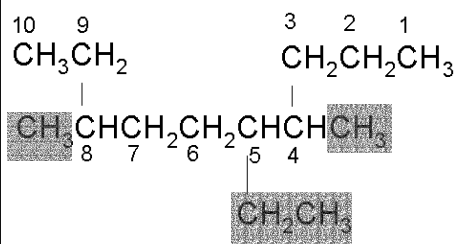
48

Localizadores

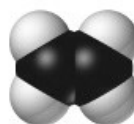
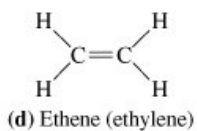
CORRECTO



INCORRECTO

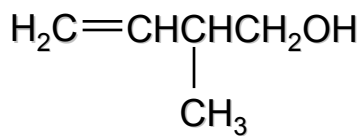
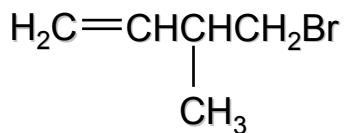
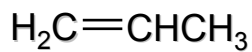
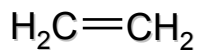


Alquenos



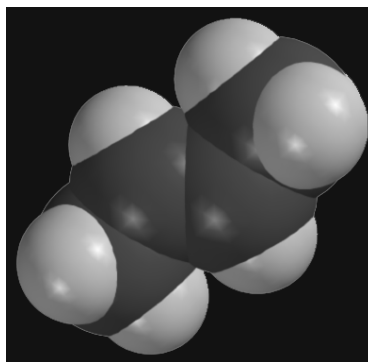
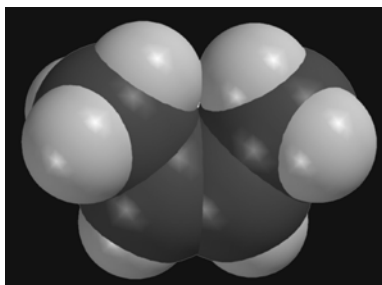
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F. G. Calvo-Flores

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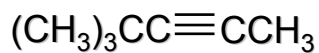
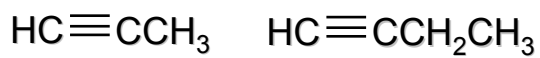


Materia prima para reacciones de polimerización

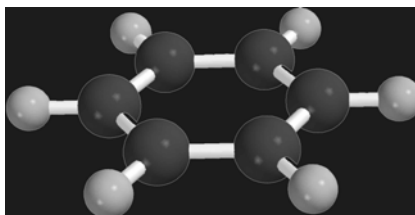
TABLE 13.1 Some Alkene Polymers and Their Uses

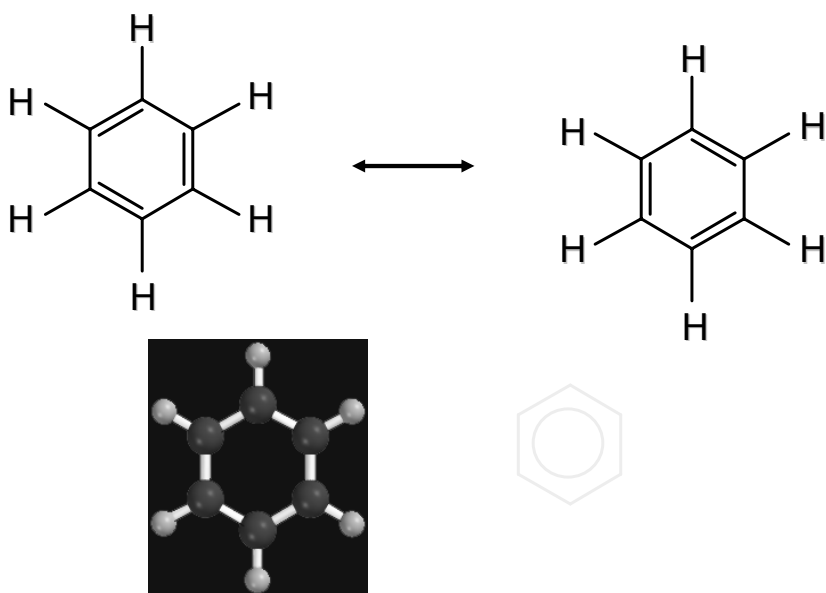
Monomer Name	Monomer Structure	Polymer Name	Uses
Ethylene	$\text{H}_2\text{C}=\text{CH}_2$	Polyethylene	Packaging, bottles
Propylene	$\text{H}_2\text{C}=\text{CH}-\text{CH}_3$	Polypropylene	Bottles, rope, pails, medical tubing
Vinyl chloride	$\text{H}_2\text{C}=\text{CH}-\text{Cl}$	Poly(vinyl chloride)	Insulation, plastic pipe
Styrene	$\text{H}_2\text{C}=\text{CH}-\text{C}_6\text{H}_5$	Polystyrene	Foams and molded plastics
Styrene and butadiene	$\text{H}_2\text{C}=\text{CH}-\text{C}_6\text{H}_5$ and $\text{H}_2\text{C}=\text{CHCH}=\text{CH}_2$	Styrene-butadiene rubber (SBR)	Synthetic rubber for tires
Acrylonitrile	$\text{H}_2\text{C}=\text{CH}-\text{C}\equiv\text{N}$	Orlon, Acrilan	Fibers, outdoor carpeting
Methyl methacrylate	$\text{H}_2\text{C}=\text{C}(\text{CH}_3)\text{COOCH}_3$	Plexiglas, Lucite	Windows, contact lenses, fiber optics
Tetrafluoroethylene	$\text{F}_2\text{C}=\text{CF}_2$	Teflon	Nonstick coatings, bearings, replacement heart valves and blood vessels

Alquinos



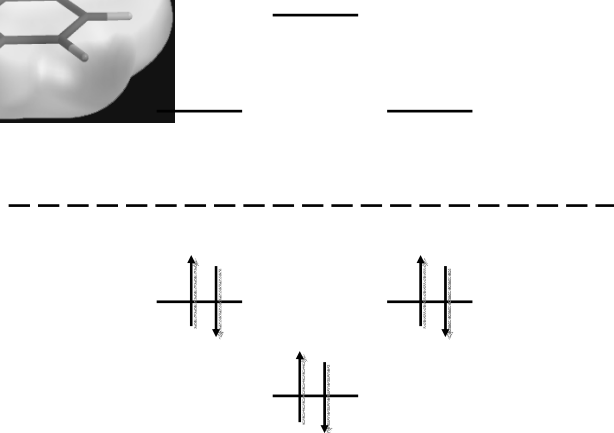
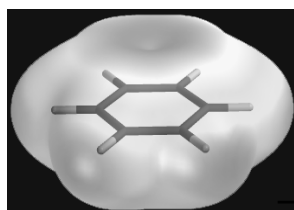
Hidrocarburos aromáticos





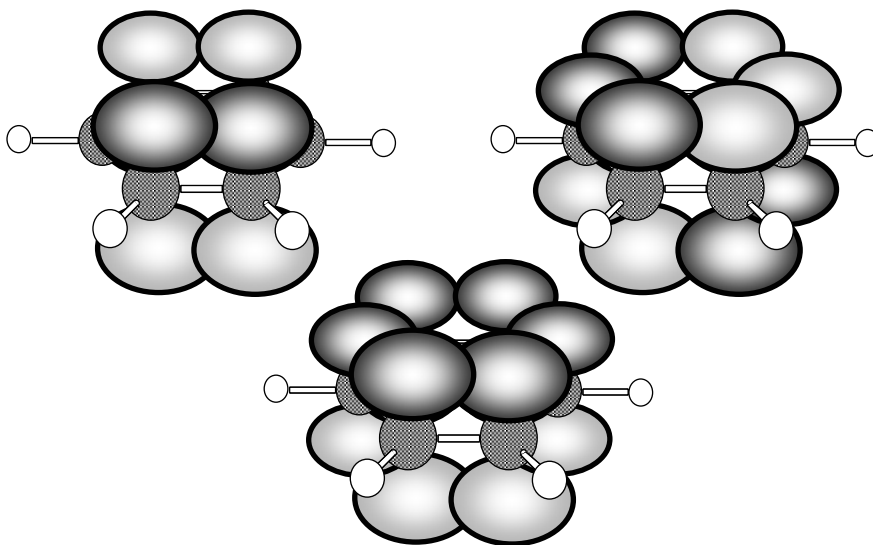
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F. G. Calvo-Flores

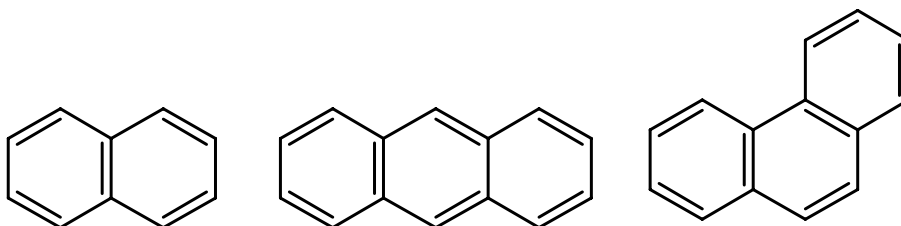
58



F. G. Calvo-Flores

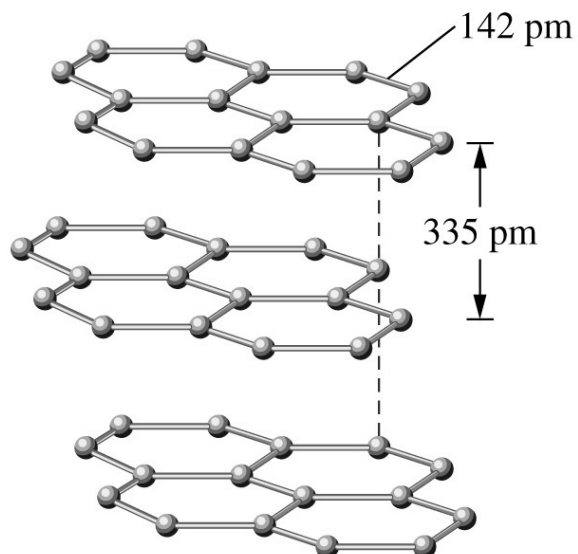
59

Hidrocarburos aromáticos policíclicos



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F. G. Calvo-Flores

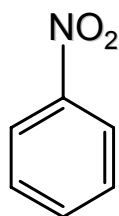
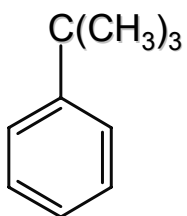
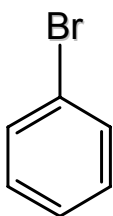
61

Bencenos sustituidos

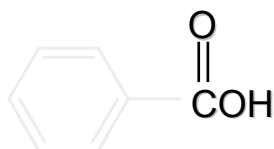
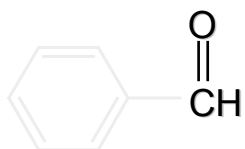
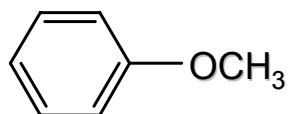
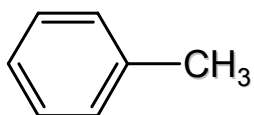
- Monosustituidos
- Disustituidos
- Polisustituidos

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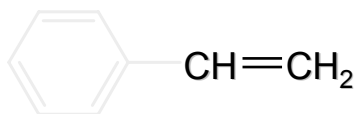
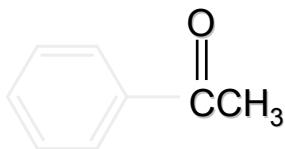
62



Algunos hidrocarburos aromáticos con nombre no sistemático



Algunos hidrocarburos aromáticos con nombre no sistemático

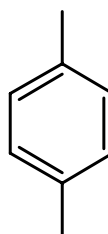
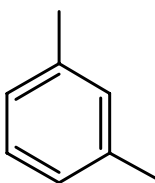
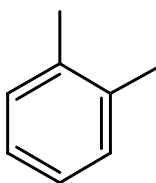


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H. Aromáticos disustituídos

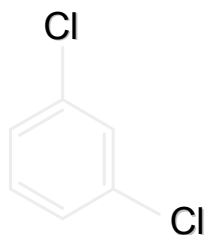
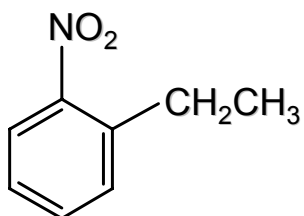
Orto, Meta, Para



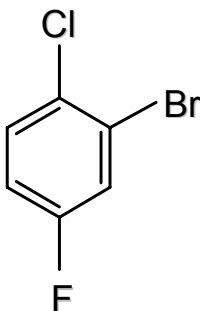
F. G. Calvo-Flores

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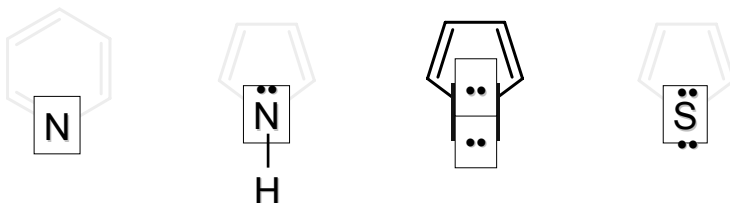
H. Aromáticos disustituídos



H. Aromáticos polisustituídos



Heterociclos aromáticos

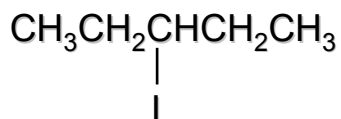
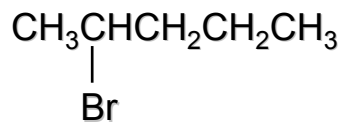
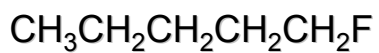


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Haluros de alquilo

Nomenclatura sustitutiva

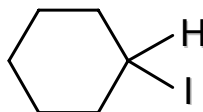
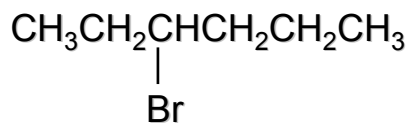
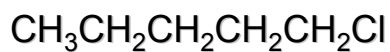
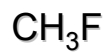


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Haluros de alquilo

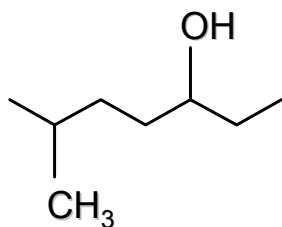
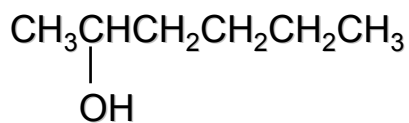
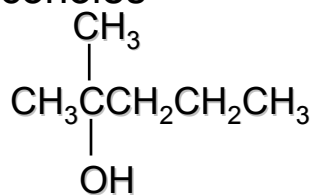
Nomenclatura radical-función



F. G. Calvo-Flores

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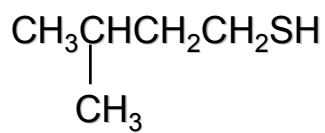
Alcoholes



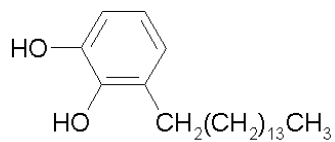
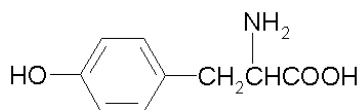
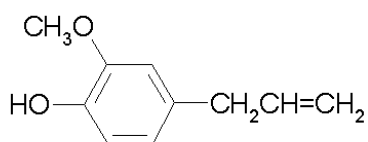
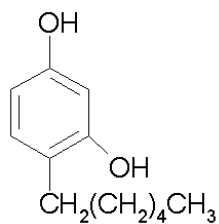
F. G. Calvo-Flores

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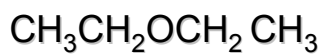
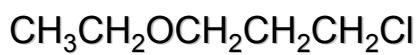
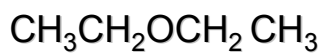
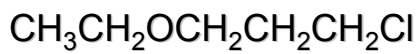
Tioles (mercaptanos)



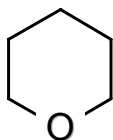
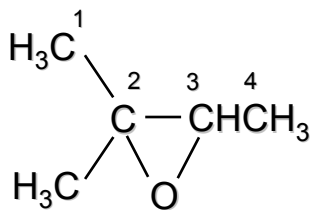
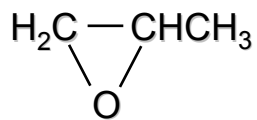
Fenoles



Éteres



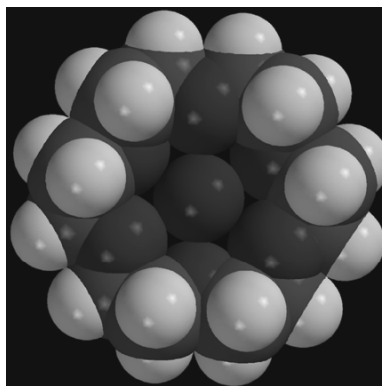
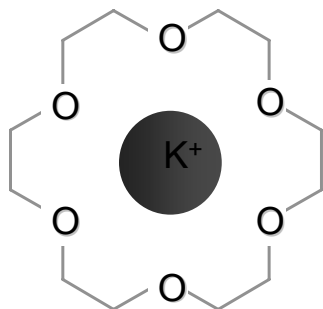
Epóxidos y otros éteres cíclicos



F. G. Calvo-Flores

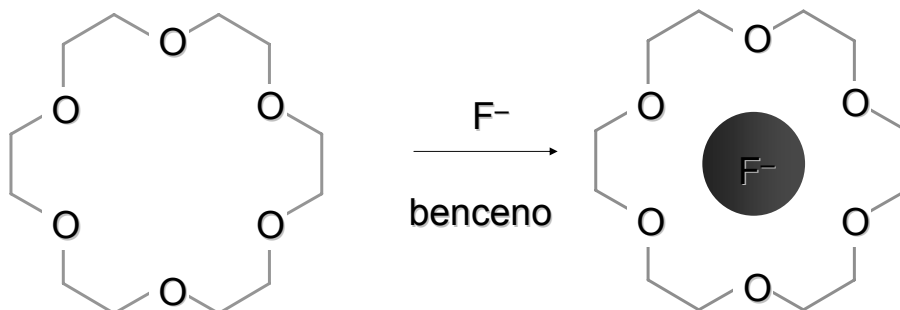
77

18-Corona-6



F. G. Calvo-Flores

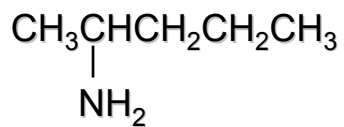
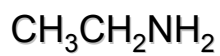
78



F. G. Calvo-Flores

79

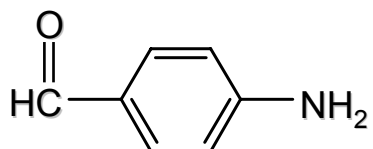
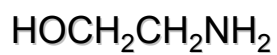
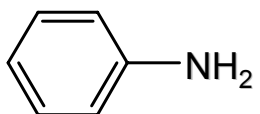
Aminas



Amino como susituyente

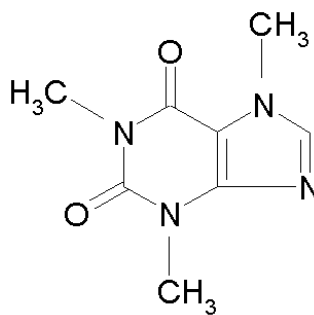
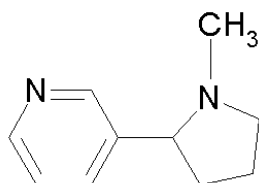
F. G. Calvo-Flores

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F. G. Calvo-Flores

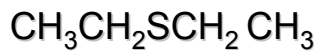
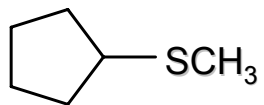
81



F. G. Calvo-Flores

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Sulfuros

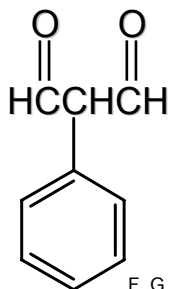
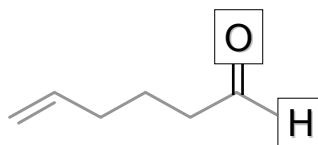
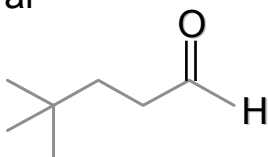


Sulfóxidos y sulfonas



Aldehídos

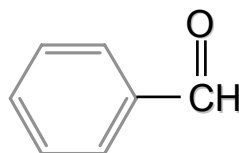
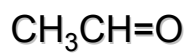
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Nombres no sistemáticos

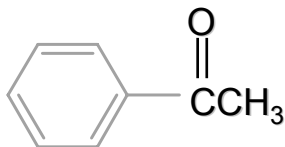
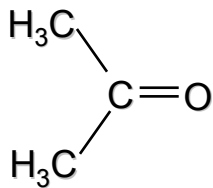
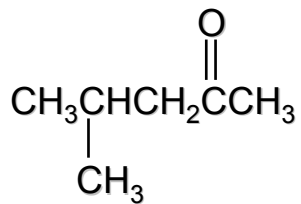
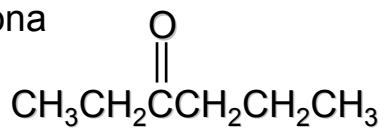


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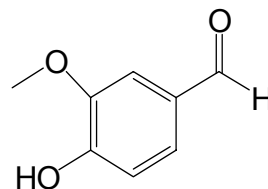
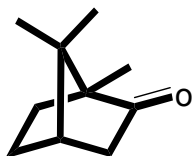
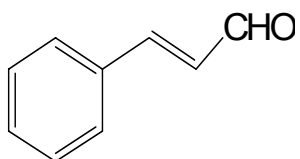
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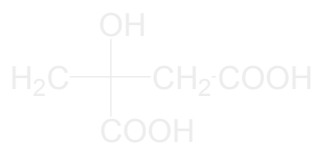
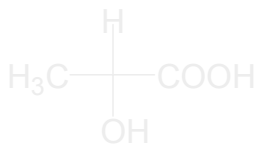
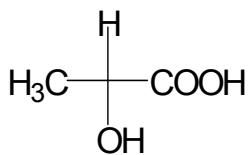
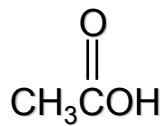
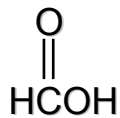


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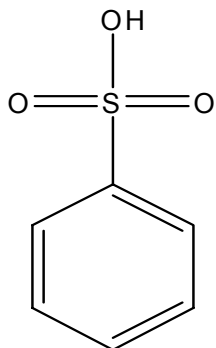
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Ácidos carboxílicos

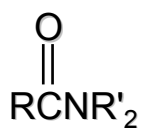
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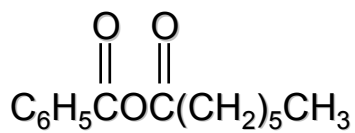
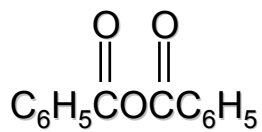
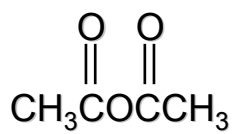
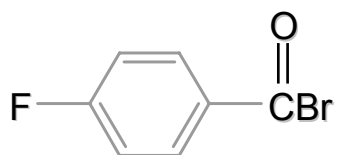
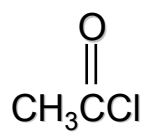


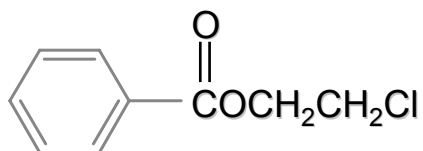
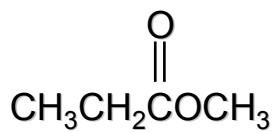
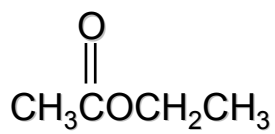
Ácidos sulfónicos



Derivados de ácidos

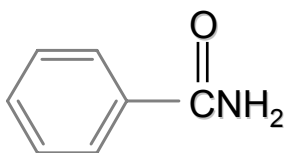
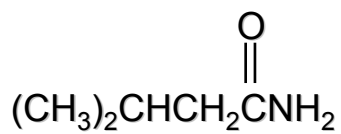
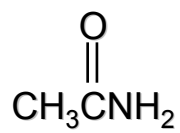






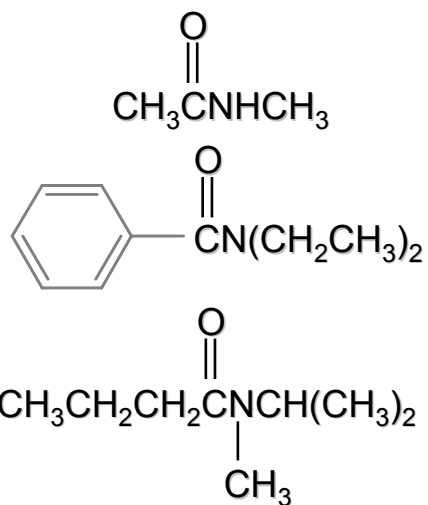
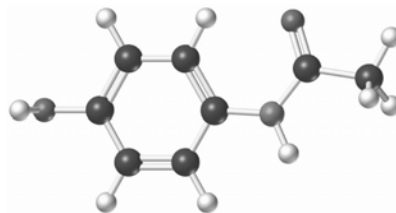
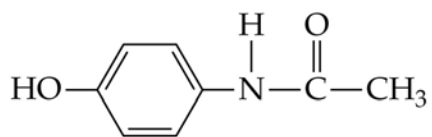
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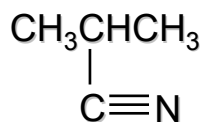
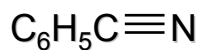
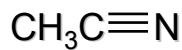


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Nitrilos



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TABLE 2-3 Common Functional Groups

Compound class	General structure ^a	Functional group	Example
Alkanes	R—H	None	CH ₃ CH ₂ CH ₂ CH ₃ Butane
Haloalkanes	R— $\ddot{\text{X}}$: (X = F, Cl, Br, I)	— $\ddot{\text{X}}$:	CH ₃ CH ₂ — $\ddot{\text{Br}}$: Bromoethane
Alcohols	R— $\ddot{\text{O}}\text{H}$	— $\ddot{\text{O}}\text{H}$	$\begin{array}{c} \text{H} \\ \\ (\text{CH}_3)_2\text{C}—\ddot{\text{O}}\text{H} \end{array}$ 2-Propanol (Isopropyl alcohol)
Ethers	R— $\ddot{\text{O}}$ —R'	— $\ddot{\text{O}}$ —	CH ₃ CH ₂ — $\ddot{\text{O}}$ —CH ₃ Methoxyethane (Ethyl methyl ether)
Thiols	R— $\ddot{\text{S}}\text{H}$	— $\ddot{\text{S}}\text{H}$	CH ₃ CH ₂ — $\ddot{\text{S}}\text{H}$ Ethanethiol
Alkenes	$\begin{array}{c} (\text{H})\text{R} \quad \text{R}(\text{H}) \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ (\text{H})\text{R} \quad \text{R}(\text{H}) \end{array}$	$\diagdown \text{C}=\text{C} \diagup$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{C}=\text{CH}_2 \\ \\ \text{CH}_3 \end{array}$ 2-Methylpropene
Alkynes	(H)R—C≡C—R(H)	—C≡C—	CH ₃ C≡CCH ₃ 2-Butyne

^aThe letter R denotes an alkyl group (see text). Different alkyl groups can be distinguished by adding primes to the letter R: R', R'', and so forth.

TABLE 2-3 Common Functional Groups (continued)

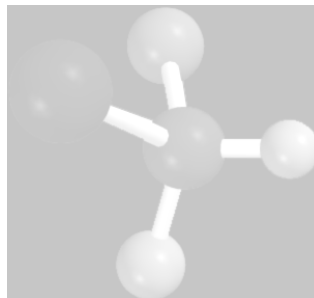
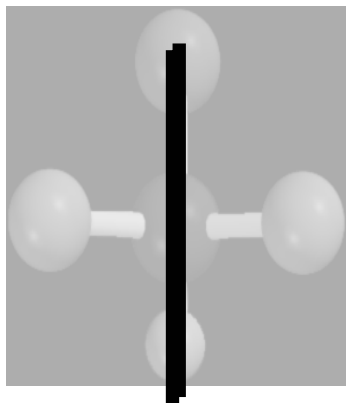
Compound class	General structure ^a	Functional group	Example
Aromatic compounds			Methylbenzene (Toluene)
Aldehydes			Propanal
Ketones			3-Hexanone
Carboxylic acids			Propanoic acid
Anhydrides			Propanoic anhydride

^aThe letter R denotes an alkyl group (see text). Different alkyl groups can be distinguished by adding primes to the letter R: R', R'', and so forth.

TABLE 2-3 Common Functional Groups (continued)

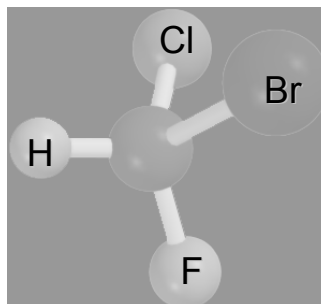
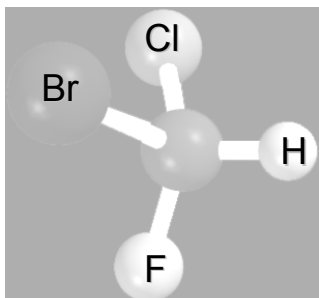
Compound class	General structure ^a	Functional group	Example
Esters			Methyl propanoate (Methyl propionate)
Amides			Butanamide
Nitriles			Ethanenitrile (Acetonitrile)
Amines			(CH₃)₃N N,N-Dimethylmethanamine (Trimethylamine)

Carbonos quirales



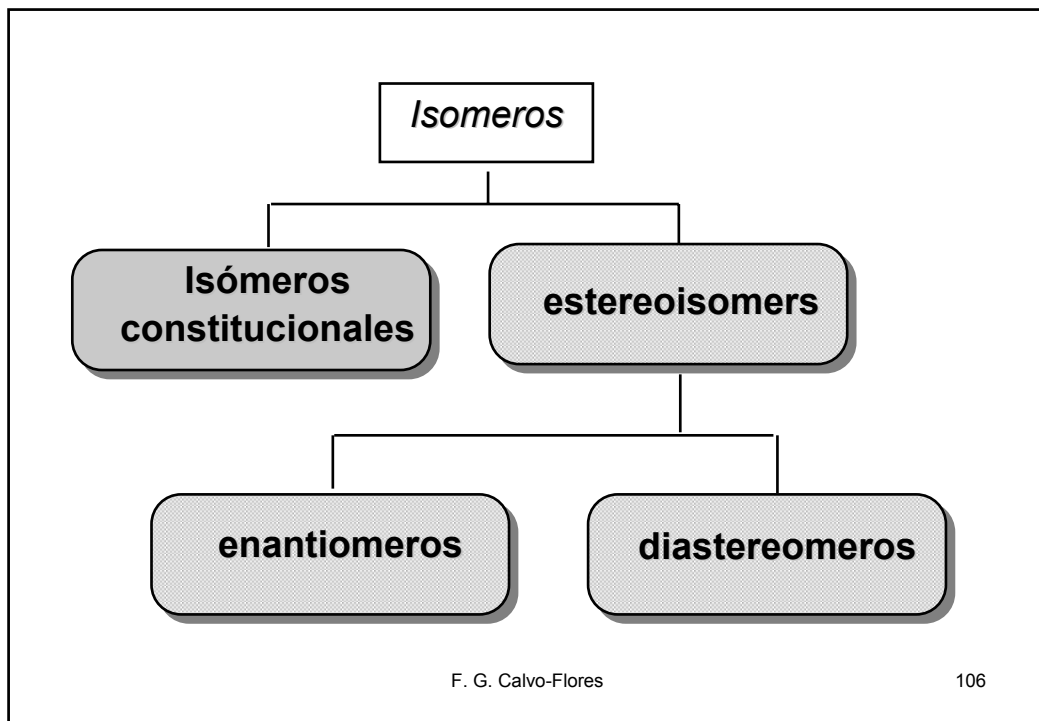
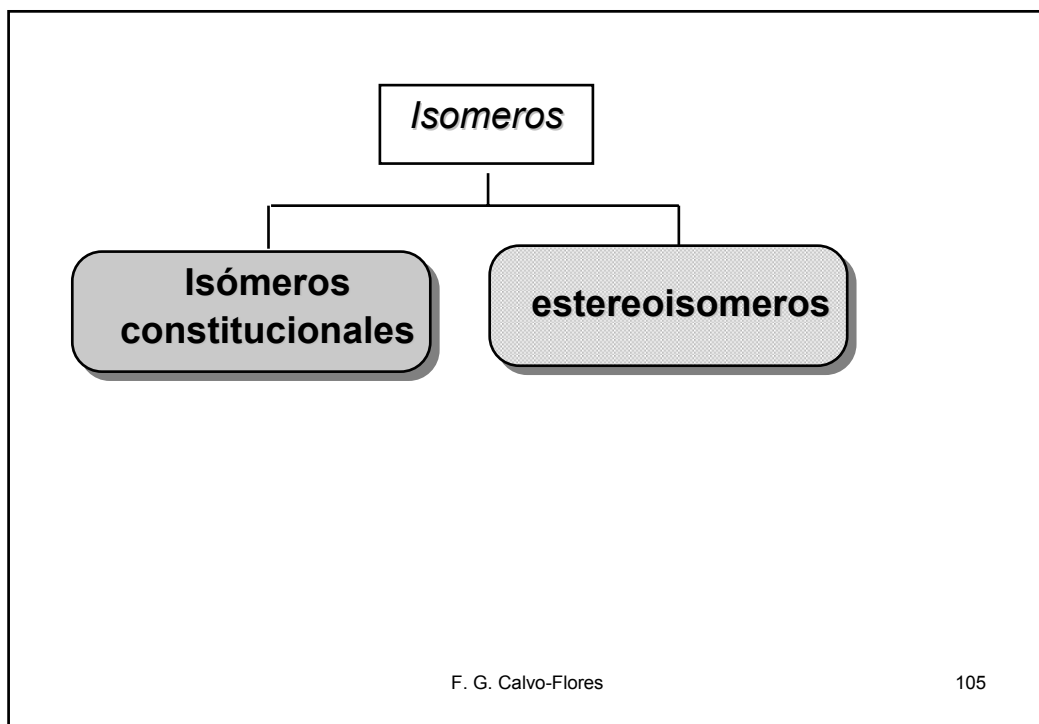
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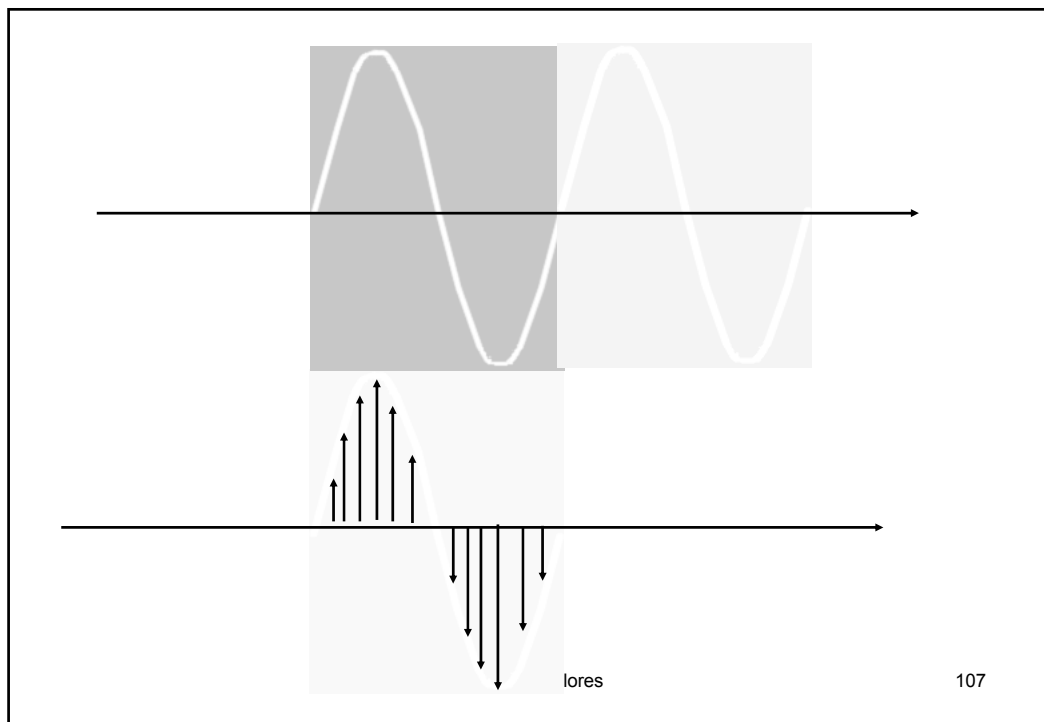
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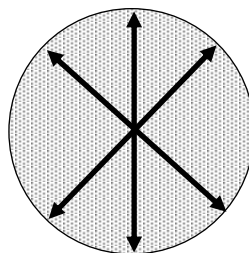
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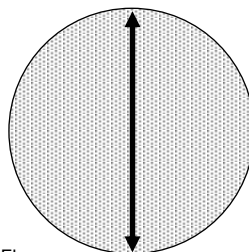


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luz normal
(no polarizada)

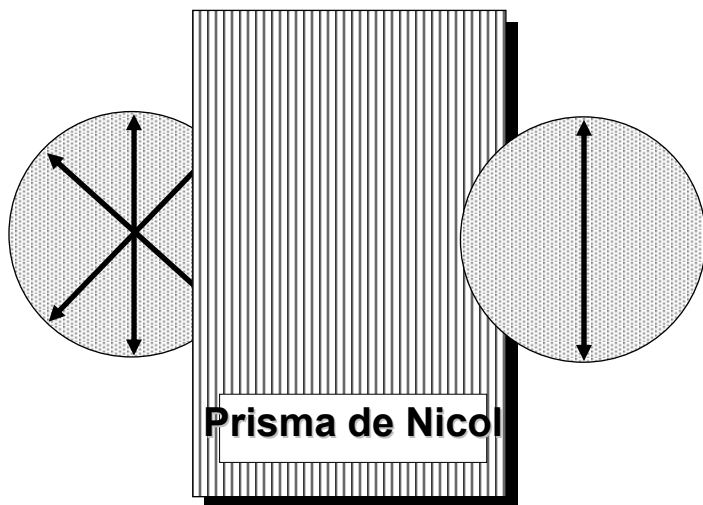


luz polarizada en el
plano



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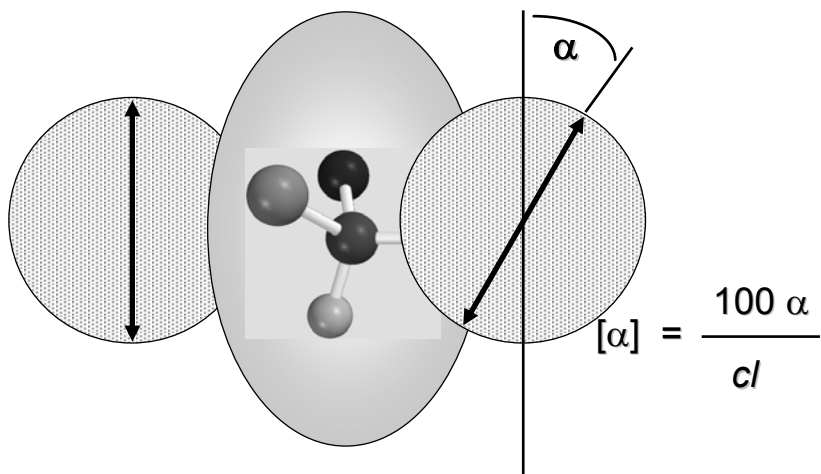
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Prisma de Nicol

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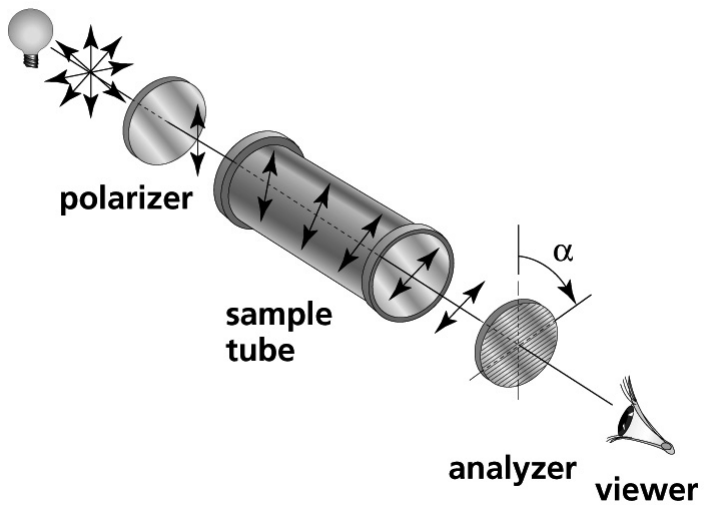
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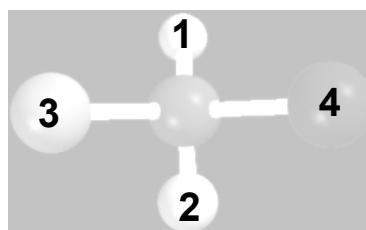
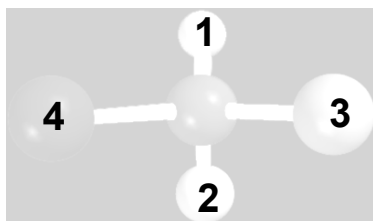
110

light
source



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