Chapter 10

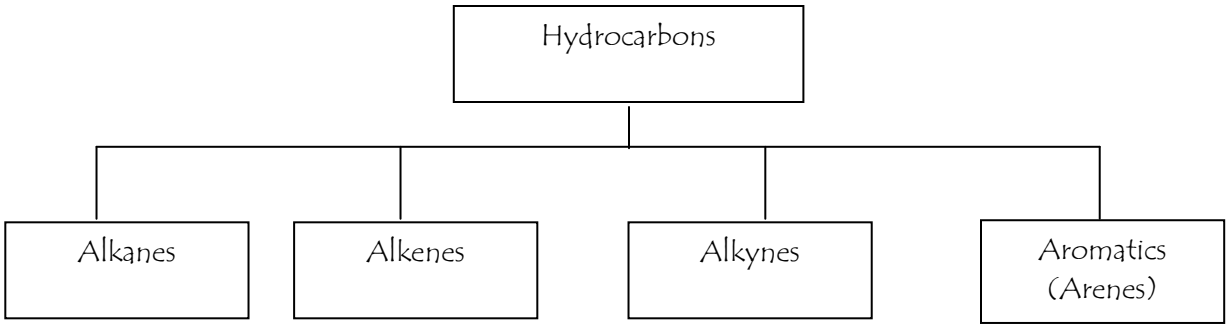
Hydrocarbon Nomenclature & Chirality

Hydrocarbons Part 3: IUPAC Nomenclature

Naming Hydrocarbons

IUPAC = International Union of Pure & Applied Chemistry

There are 4 types of hydrocarbons.



Alkanes are _____ hydrocarbons (aliphatic).

Alkenes, alkynes, and aromatics are _____ hydrocarbons

Names have 3 parts:

Straight chains are named using the root names from the homologous series.

Cycloalkanes are named using the same root names with the additional prefix "cyclo".

Alkane names end with the suffix "ane".

Alkene names end with the suffix "ene".

Alkynes end with the suffix "yne".

Root Names – the Homologous Series

# C's	Alkane Structure	Suffix name	Substituent name
1		methane	methyl
2		ethane	ethyl
3		propane	propyl
4		butane	butyl
5		pentane	pentyl
6		hexane	hexyl
7		heptane	heptyl
8		octane	octyl
9		nonane	nonyl
10		decane	decyl

$-CH_2-$

$-CH_2CH_2-$

$-CH_2CH_2CH_2-$

Guidelines for Naming Straight-Chain Hydrocarbons and Cycloalkanes

Rule 1: Assign the root by counting the carbon atoms in the chain.

Rule 2: Assign the suffix.

Rule 3: Assign a locator number to the root if a multiple-bond is present.
The multiple-bond is ALWAYS assigned the lowest possible number.

Rule 4: For cycloalkanes and alkenes, assign the cis or trans prefix if applicable.

Draw the skeletal-line structure for each of the following compounds.

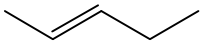
a) trans-2-hexene

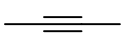
b) 3-octyne

c) cyclopentane

Give the IUPAC name for the following compounds.

a) 

b) 

c) 

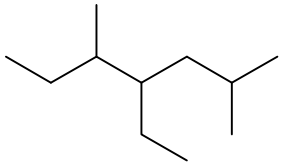
Naming Branched-Chain Hydrocarbons

Main Chain: the longest continuous C-chain

Substituents: the carbon branches from the main chain (root)

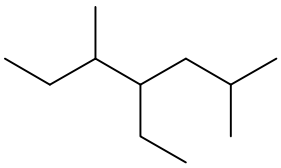
Guidelines for Naming Branched-Chain Hydrocarbons

Rule 1: Find the longest continuous C-chain and assign the root name.



Rule 2: Assign the suffix based on the type of carbon-carbon bonds

Rule 3: Name each substituent.



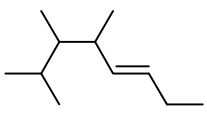
Rule 4: Assign a locator number to all substituents.
Double & triple bonds are assigned the lowest possible number.
If there are no C=C or C≡C bonds, then the main chain is numbered to give the first branch the lowest possible number.

Rule 5: Assemble the prefix name by listing the substituents in alphabetical order. Place the locator number in front of each substituent name separated by a hyphen.

If a substituent is repeated more than once along a chain, then insert an additional prefix di- (2), tri- (3), or tetra- (4) in front.

Rule 6: For cycloalkanes and alkenes, assign the cis or trans prefix if applicable.

Give the IUPAC for the following compound.

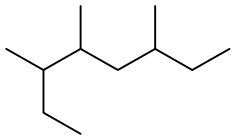


Draw the skeletal-line structure for each of the following compounds.

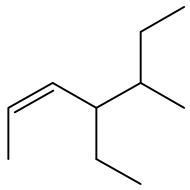
a) cis-4-ethyl-2-hexene

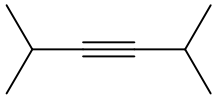
b) trans-1-ethyl-3-methylcyclohexane

Give the IUPAC name for the following compounds.

a) 

Video Lecture Correction for (a)
3,4,6-trimethyloctane

b) 

c) 

Guidelines for Naming Substituted Benzenes

Rule 1: Assign the root name.

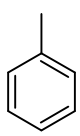
Rule 2: Name each substituent.

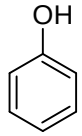
Rule 3: If there is more than one substituent present, then we number the benzene ring to give the 2nd substituent the lowest possible number. The first substituent is always given the number 1.

Rule 4: Assemble the prefix name by listing the substituents in alphabetical order. Place the locator number in front of each substituent name separated by a hyphen.

If a substituent is repeated more than once along a chain, then insert an additional prefix di- (2), tri- (3), or tetra- (4) in front.

Memorize the following common benzene derivatives.

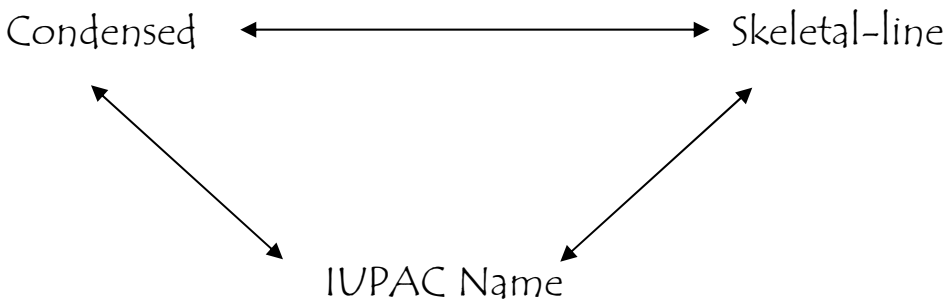


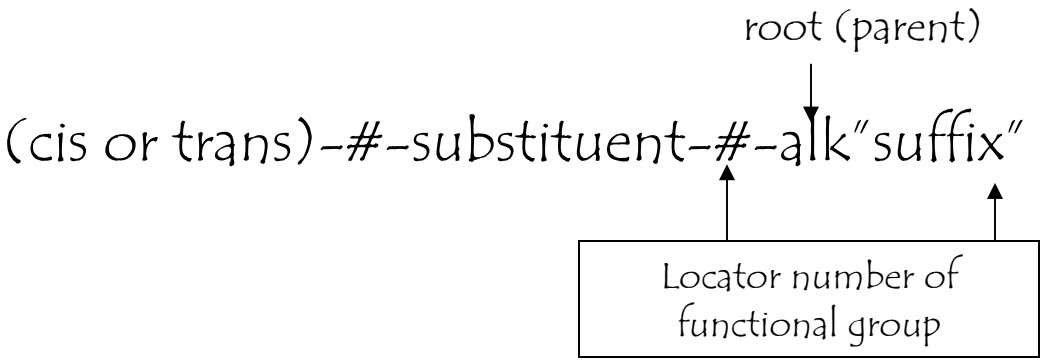


Draw the skeletal-line structure for 3-propylphenol.

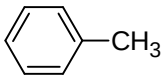
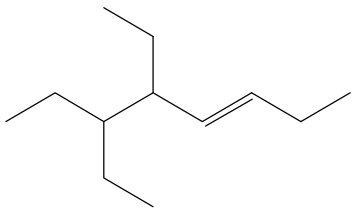
Give the IUPAC name for $C_6H_5CH_2CH_2CH_2CH_3$.

Hydrocarbon Structure & Nomenclature Review

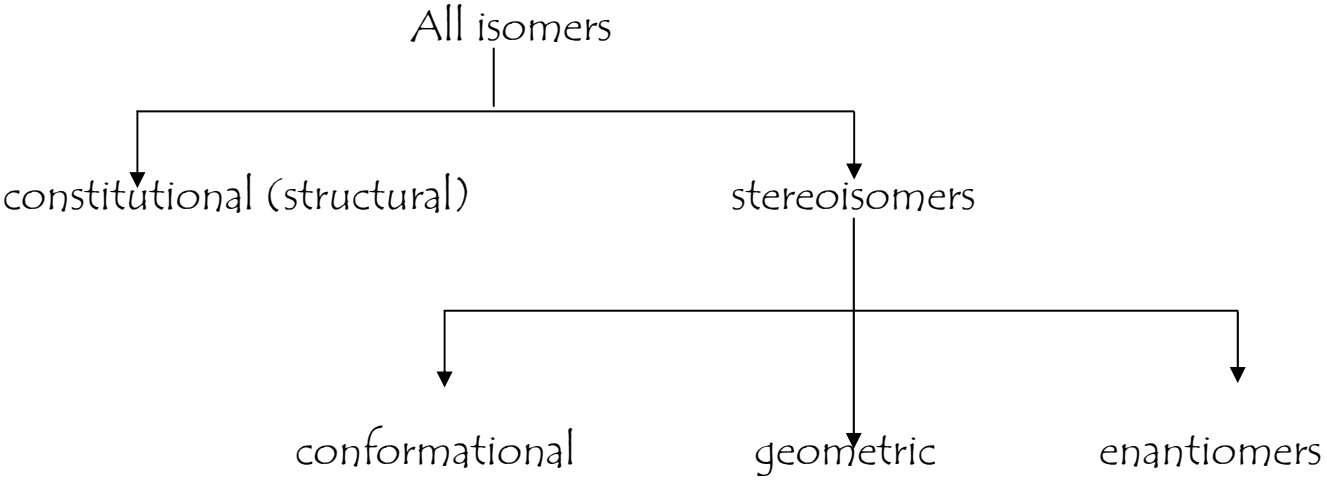




Complete the table.

IUPAC Name	Skeletal-line Structure	Condensed Structure
4-ethyl-2-methyloctane		
		
		$CH_3CH_2CH_2CH(CH_3)CH_3$
cis-6-ethyl-7-methyl-3-octene		
		
		$CH_2=C(CH_3)CH_2CH_3$

Hydrocarbons Part 5: Chirality for Allied Health Students



Stereoisomers: same connectivity, but different spatial arrangements

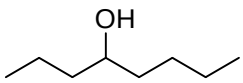
chiral carbon:

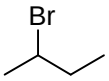
chiral carbon = chirality center = stereocenter = asymmetric carbon

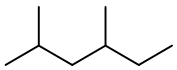
2-butanol is a chiral.

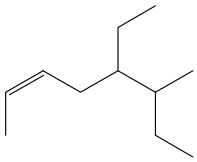
2-propanol is achiral.

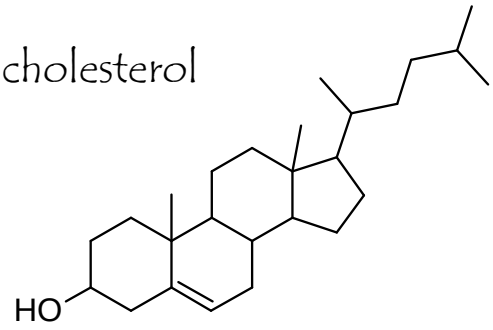
Star the chiral carbons

a) 

b) 

c) 

d) 

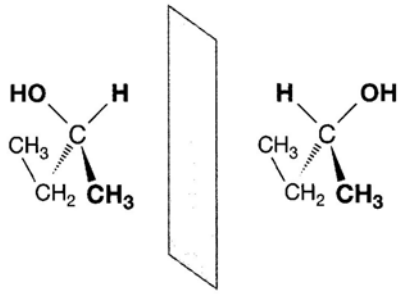
e) cholesterol 

Draw the skeletal-line structure for 3-ethyl-4-methylhexane and star any chiral carbons.

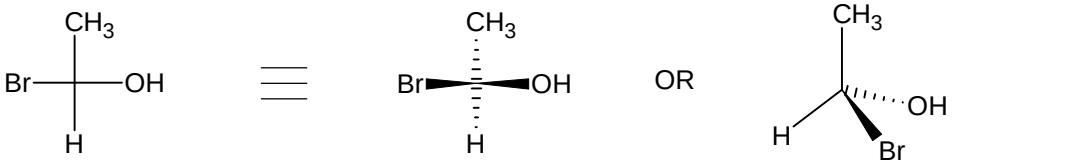
Enantiomers

Compounds with one chiral carbon exist as a "pair of enantiomers".

The pairs are distinguished by R/S or d/l or +/- or D/L.

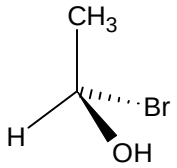
chiral compounds 

Drawing Enantiomers

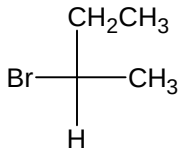


Fischer Projections Perspective formula

Draw the mirror image for the following compound.



Draw the mirror for the following compound.



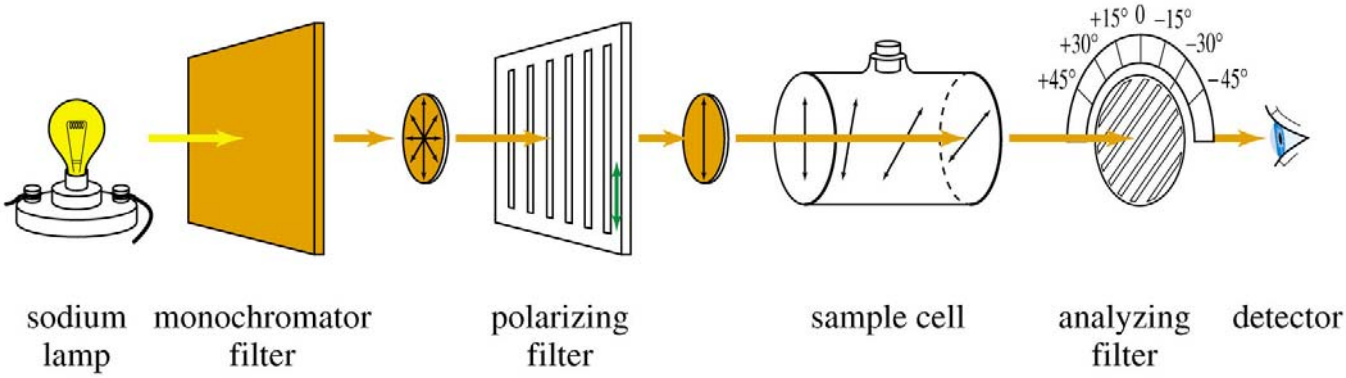
Enantiomers are Optical Isomers

Enantiomers share many properties

bp, mp, density, refractive index & solubilities

Enantiomers interact differently with polarized light (optical activity).

A pure sample of a chiral compound rotates the plane of the polarized light.



The pair of enantiomers is distinguished by the direction they rotate polarized light:

d = dextrorotatory = (+) for clockwise rotation

l = levorotatory = (-) for counter-clockwise rotation.

Racemic mixture: 1:1 mixture of a pair of enantiomers

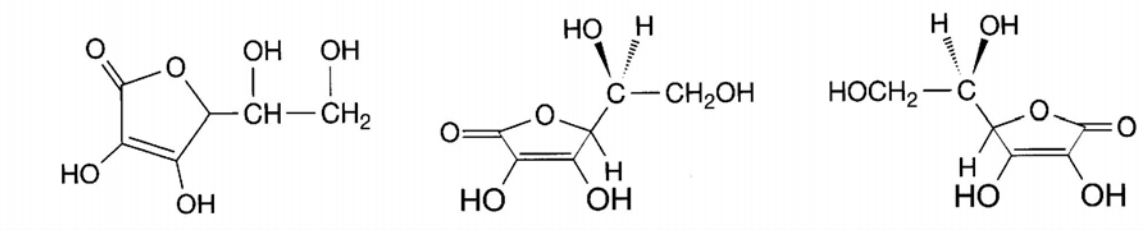
D-glucose rotates plane polarized light +52.7°.

What is the rotation for L-glucose?

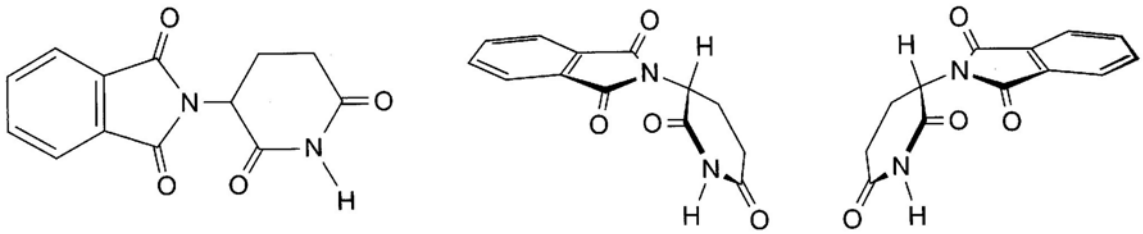
What is the rotation of a racemic mixture of D-glucose and L-glucose?

Biochemistry is mostly chiral.
Enantiomers have different biological effects.

vitamin C (ascorbic acid)



thalidomide



THC {(3R, 4R)-(-)-trans-delta-9-tetrahydrocannabinol} is 13 to 230 times more active than its enantiomer.
Star the chiral carbons in THC.