Exam 2 Test Prep

IUPAC Naming

Naming Alkanes:

Number of C atoms	Formula	Name
1	CH_4	methane
2	C_2H_6	ethane
3	C_3H_8	propane
4	C_4H_{10}	butane
5	C_5H_{12}	pentane
6	C_6H_{14}	hexane
7	C_7H_{16}	heptane
8	C_8H_{18}	octane
9	C_9H_{20}	nonane
10	$C_{10}H_{22}$	decane

1. If there is a competition of numbering chains of an equal length, number so that you get the _most_ amount of substituents

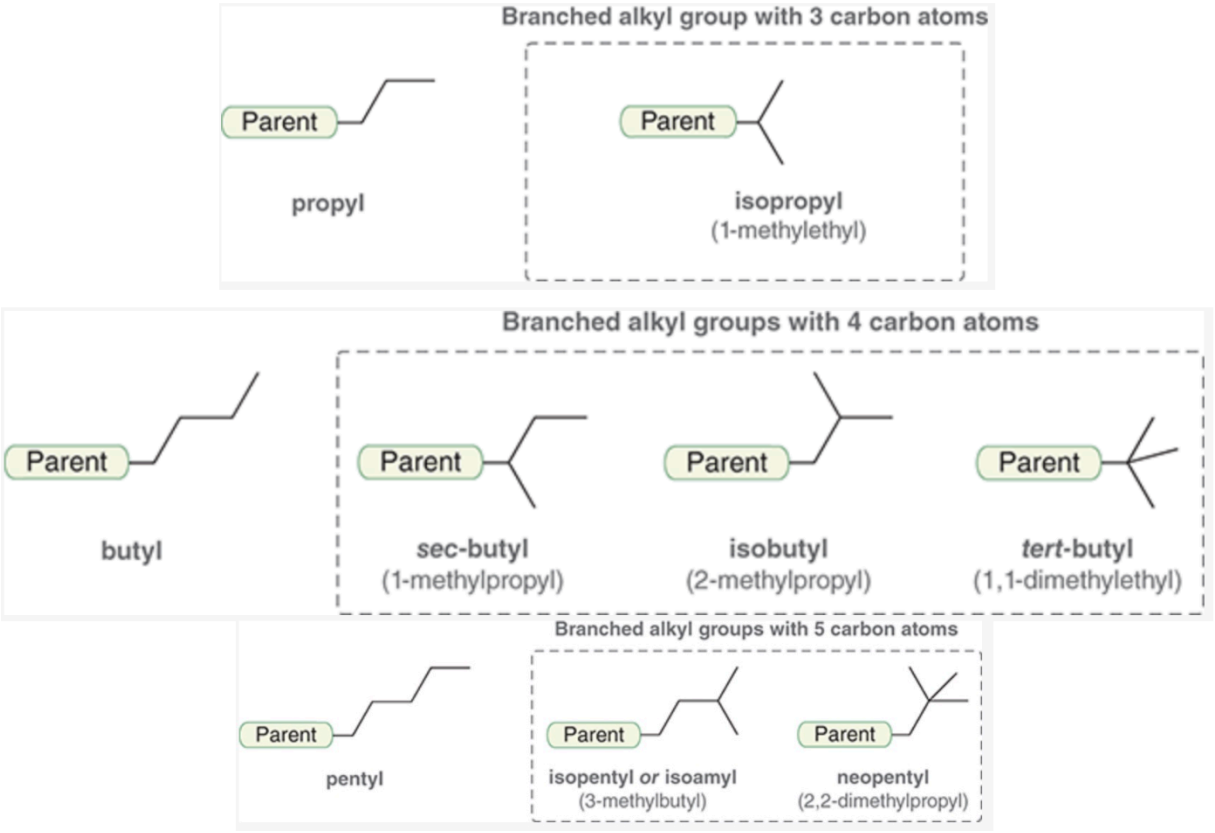
2. Use _cyclo_ to indicate a ring

3. To name alkyl substituents _Prefix_ + _yl_

4. Number the parent chain and assign substituents the _lowest_ number possible according to IUPAC rules

5. To put names together, _alphabetize_ substituents and combine using _, and -_

Common names of alkyl groups (memorize)



When a substituent appears more than once in a molecule:

# of functional groups:	Prefix:
2	Di-
3	Tri-
4	Tetra-
5	Penta-
6	Hexa-

Naming Alkyl Halides

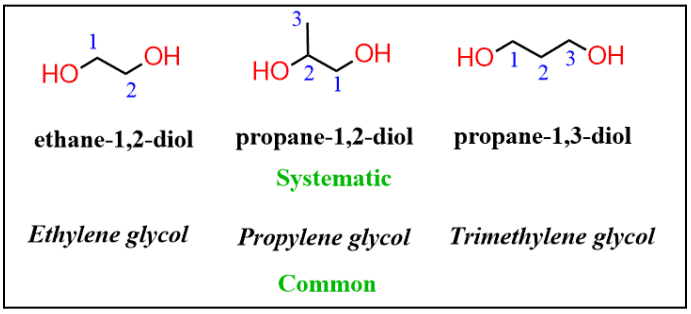
1. Halogen is treated as a _____

Naming Alcohols

1. Number the chain that includes the hydroxyl group
2. Ends in "-ol"
3. Alcohol gets priority (for the purposes of this class)

Naming Diols

1. Similar to alcohols just make sure you indicate the prefix of multiple alcohols
2. Remember the common names of basic diols



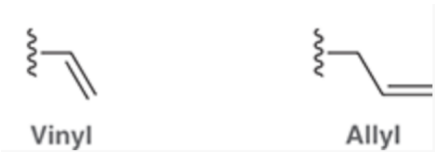
Bicyclic Compounds

1. Find total # of carbons
2. Use "bicyclo"
3. Find bridgeheads / paths
4. Order paths going largest → smallest #

Naming Alkenes

1. Ends in -ene
2. Use the longest chain that includes C=C
3. Pi bond is assigned lowest #

Allyl and Vinyl groups



Naming Alkynes

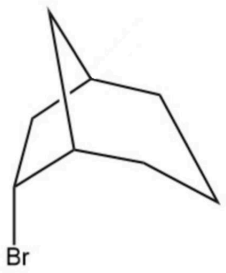
1. Use -yne
2. The triple bond should be assigned lowest #

Alkenes and Alkynes: Which Takes Priority?

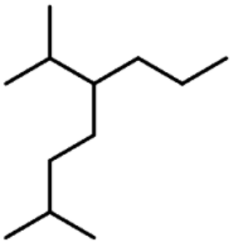
A molecule containing an alkene and alkyne with *no* higher-ranking substituents

- will be **numbered** so as to provide the lowest set of locants
- will be **named** so as to arrange the ene/yne **alphabetically**

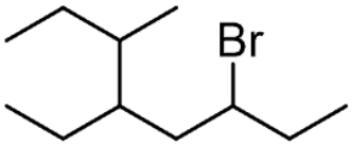
Practice



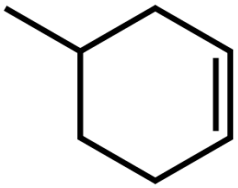
6-bromobicyclo[3.2.1]octane



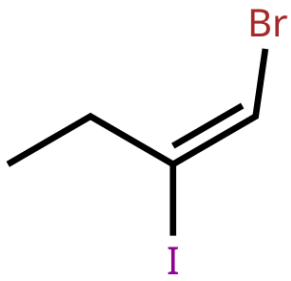
5-isopropyl-2-methyloctane



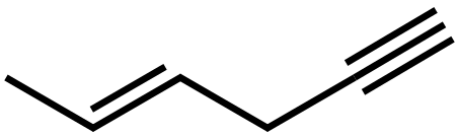
6-bromo-4-ethyl-3-methyloctane



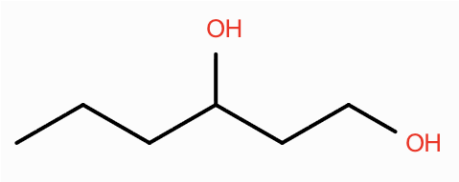
4-methylcyclohex-1-ene



1-bromo-2-iodobut-1-ene



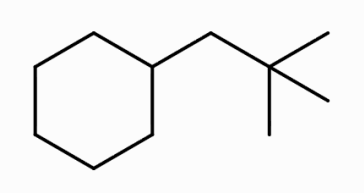
hex-4-en-1-yne



1,3-hexane diol

or

hexane-1,3-diol



neopentyl cyclohexane

or

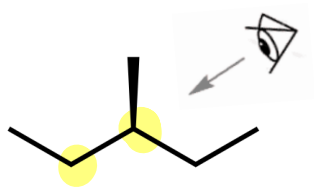
(2,2-dimethylpropyl) Cyclohexane

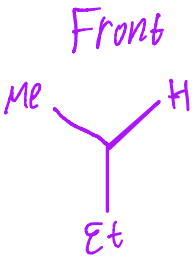
Newman Projections
A bird's eye view of the molecule!

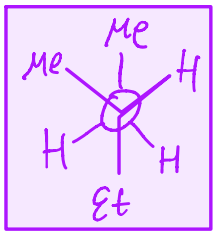
Steps to creating a Newman Projection:

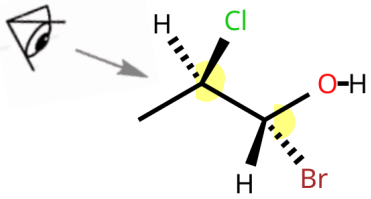
1. ID groups on the front carbon
2. ID groups on the back carbon
3. Combine

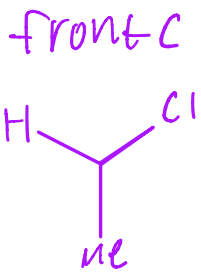
Practice: draw the Newman projection for the following bond line structures

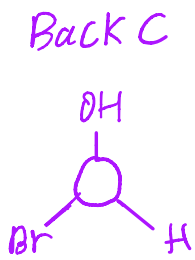


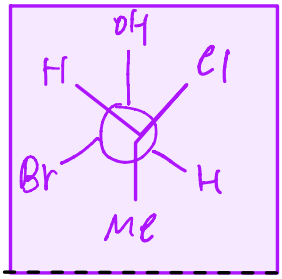


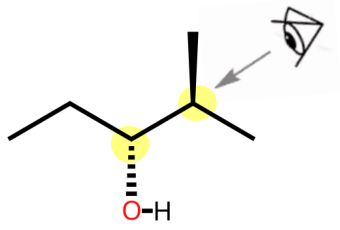


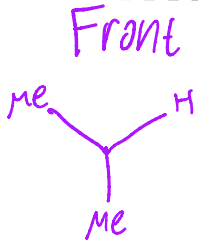


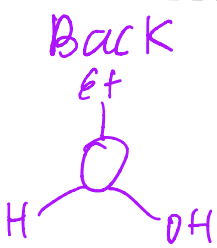


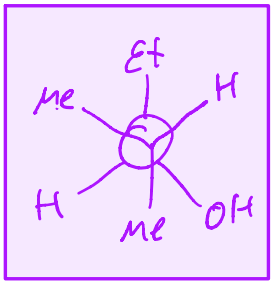


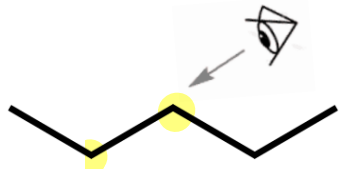


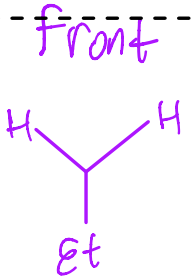


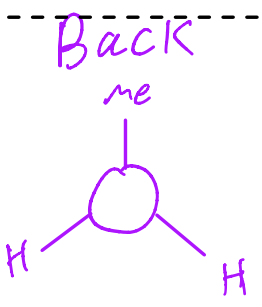


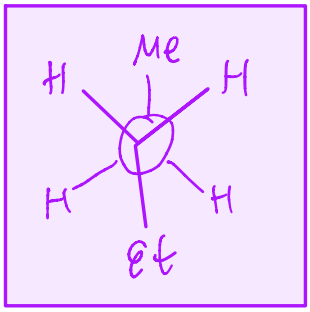




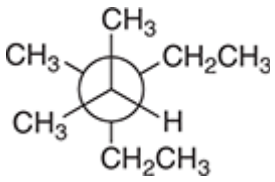


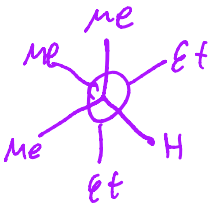


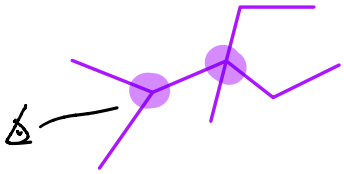




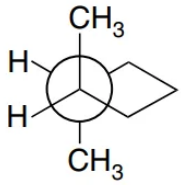
Practice: draw and name the bond line structure given the Newman projection

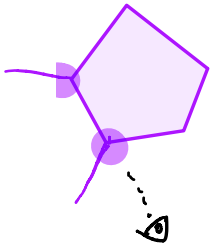




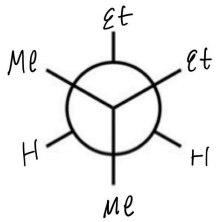


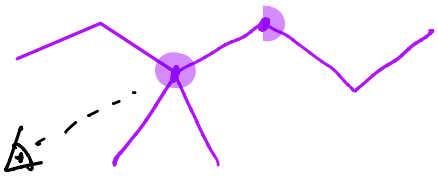
3-ethyl-2,3-dimethyl pentane



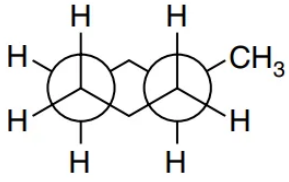


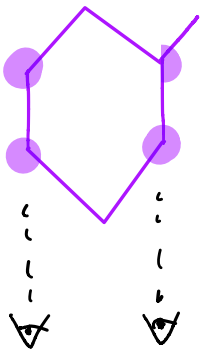
1,2-dimethyl cyclopentane



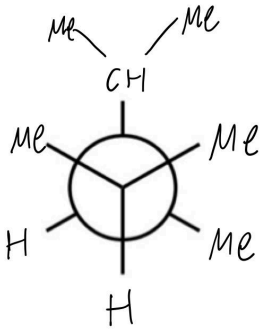


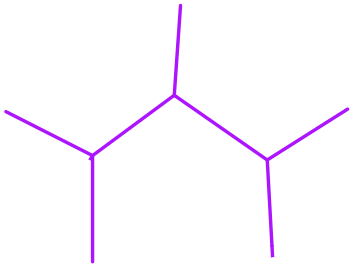
3,3-dimethyl hexane



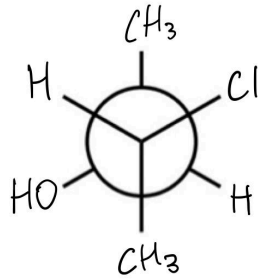


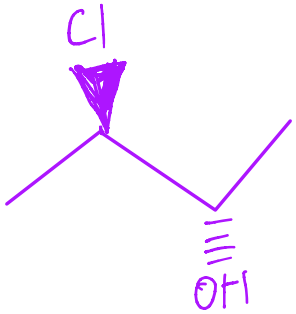
Methyl cyclohexane





2,3,4-trimethylpentane

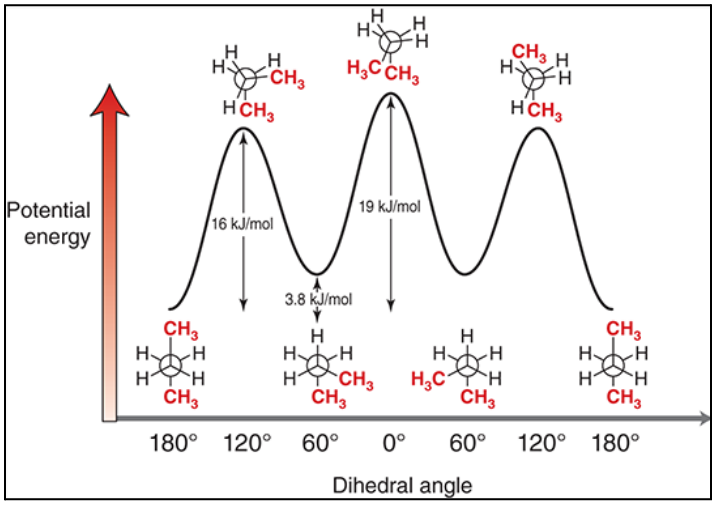




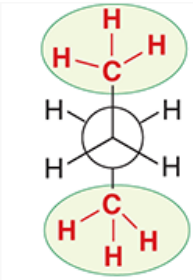
(2S,3R)-3-chloro-2-butanol

Stability of Newman projections:

Conformation analysis of butane

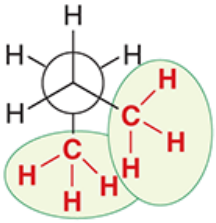


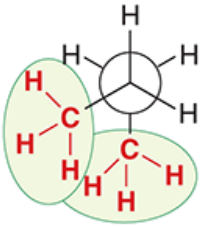
Staggered Conformations:



Anti-conformation

(larger groups are farther apart)

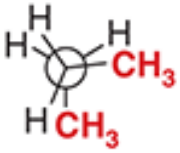


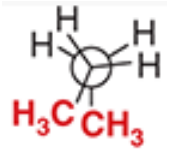


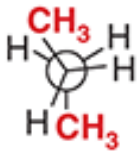
Gauche conformation

60° apart, an unfavorable interaction between 2 bulky groups

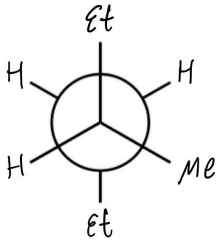
Eclipsed Conformations:

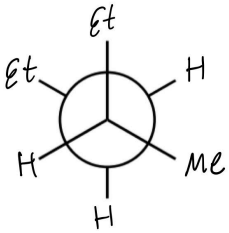


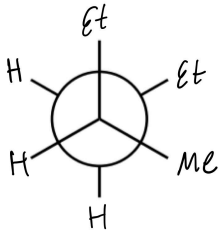




Practice: Which of the projections is higher in energy? Lower?



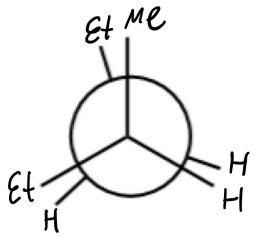


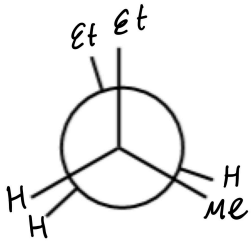


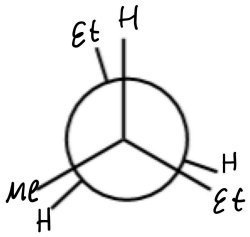
Lowest

highest

highest Lowest

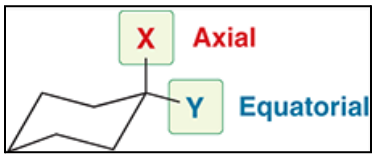


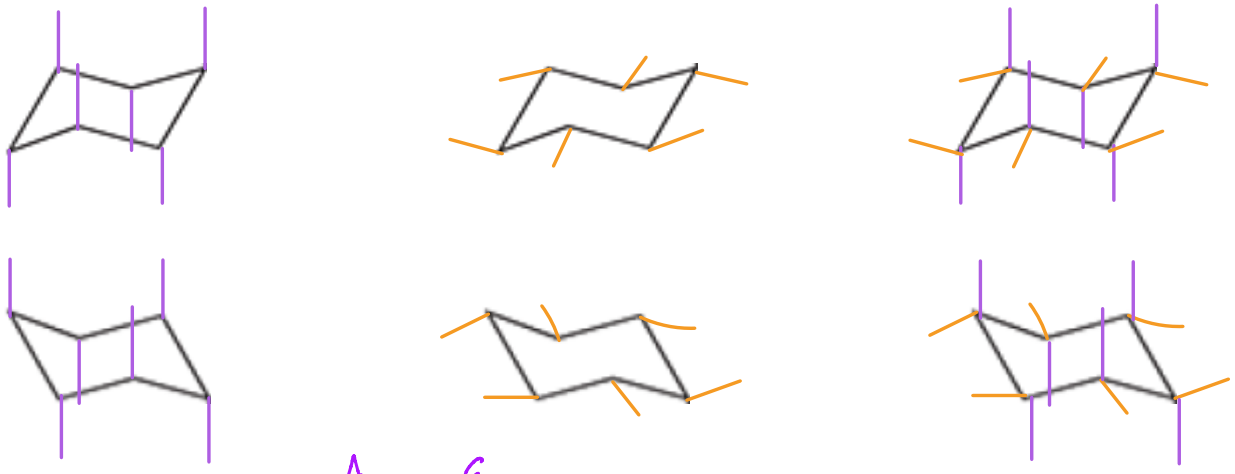




Conformations of Cycloalkanes

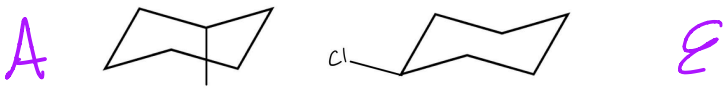
Axial and Equatorial:



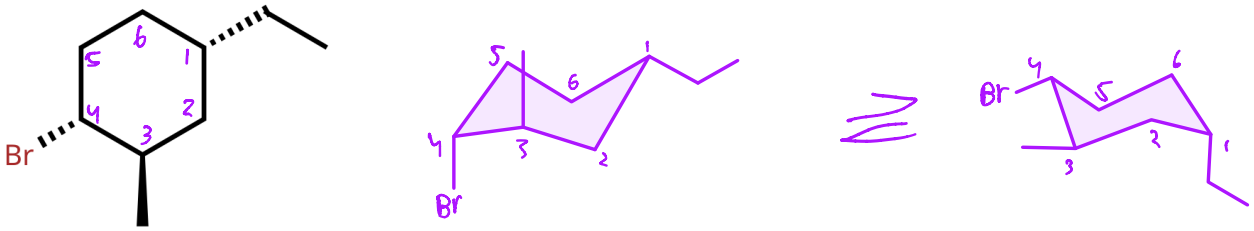


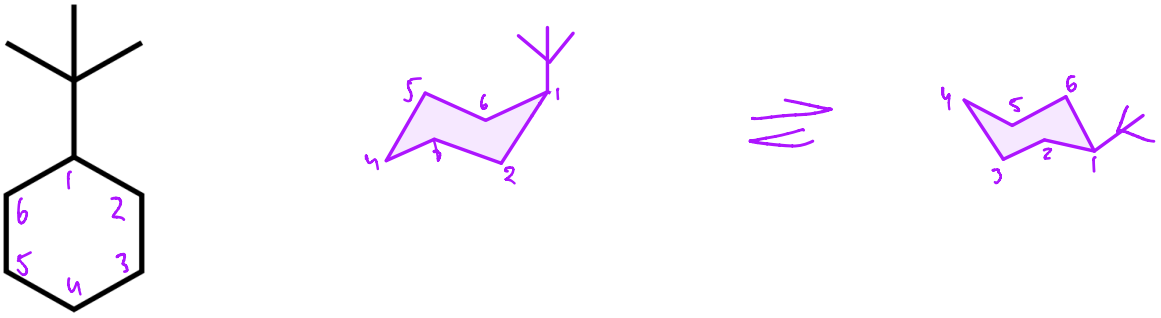
A E

Label the substituents as axial or equatorial

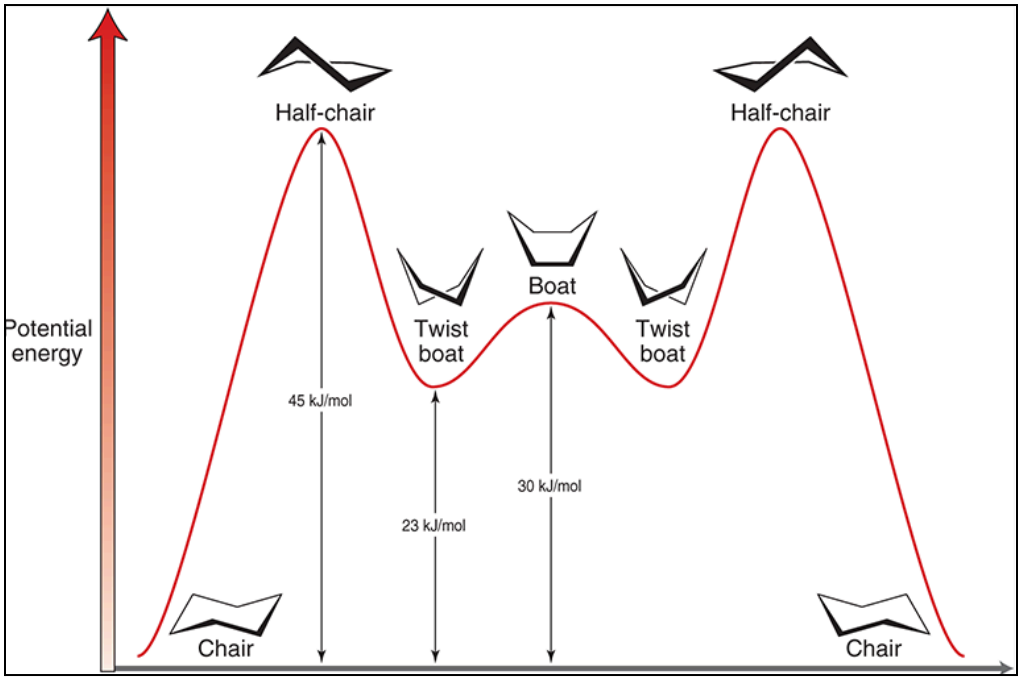


Draw the ring flip for the following compounds and identify which one is more/less stable:



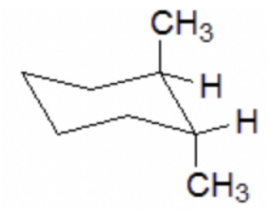
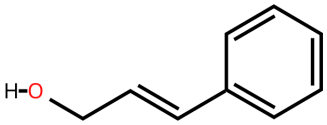
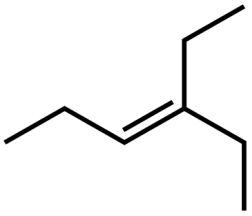
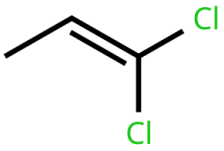
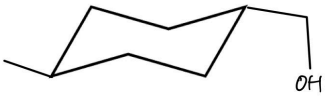


Review: Stability of chair conformations:



Cis/Trans Isomerism

Identify if the following compounds are cis, trans, or nonisomeric (neither):

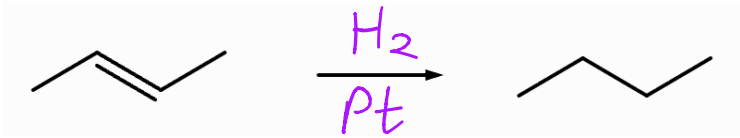
	trans		Cis
	trans		non-
	non-		trans

Index of Hydrogen Deficiency

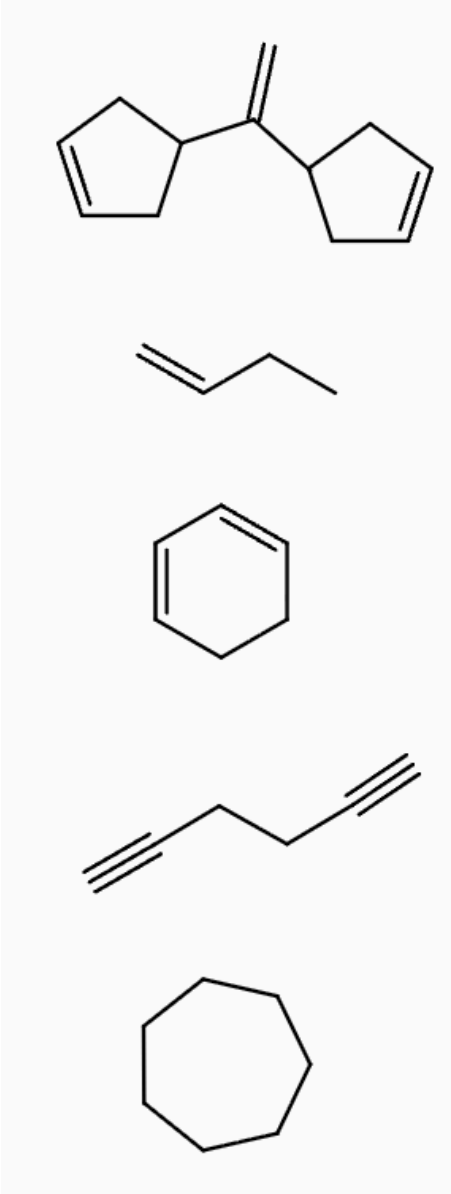
Type of Bonding	IHD Value
Single bond	0
Pi bond	1
Ring	1

What is the name of the reaction that can increase the IHD value? What elements does it use?

Hydrogenation



Identify the IHD value of the following compounds:



5

1

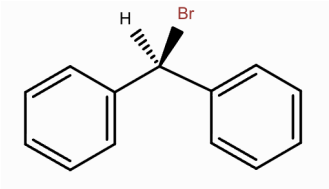
3

4

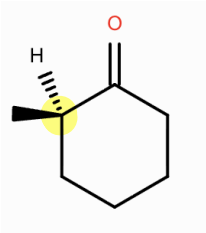
1

Stereochemistry

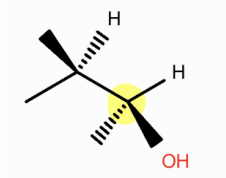
Are the following compounds chiral or achiral? If it is chiral, what is the configuration?



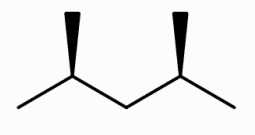
achiral



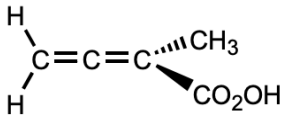
chiral, R



chiral, S



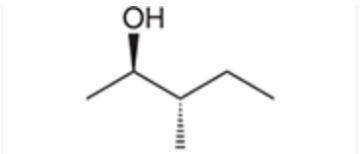
achiral (meso)



achiral

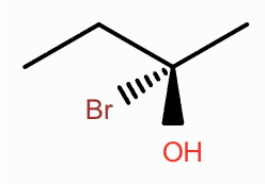
Chirality in IUPAC:

(*R*)-2-Butanol (*S*)-2-Butanol

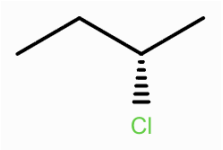


(2*R*,3*S*)-3-Methyl-2-pentanol

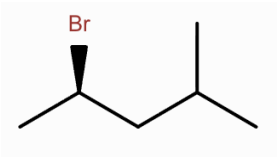
Name the structure and include the chirality:



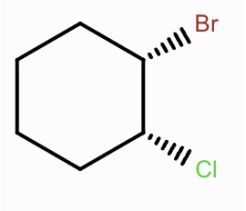
(S)-2-bromobutan-2-ol



(S)-2-chlorobutane



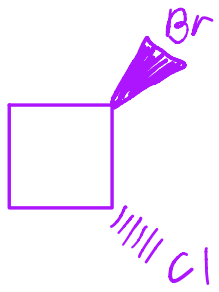
(R)-2-bromo-4-methylpentane



(1S,2R)-1-bromo-2-chlorocyclohexane

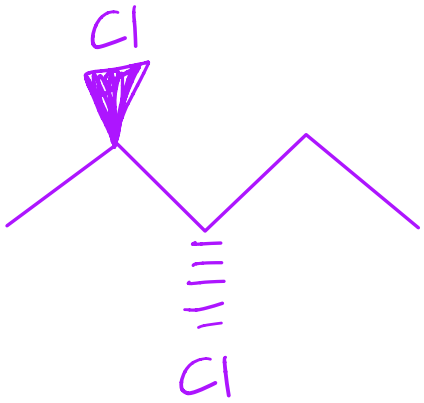
Draw the strucuture given the name:

(1R, 2R)-1-bromo-2-chlorocyclobutane



(S)-1-bromo-1-chloropropane

(2R,3S)-2,3-dichloropentane



Racemic Mixture:

Contains equal amounts of both enantiomers

Optically Pure:

A solution of 1 enantiomer

Enantiomers:

- non-superimposable mirror images

Diasteriomers:

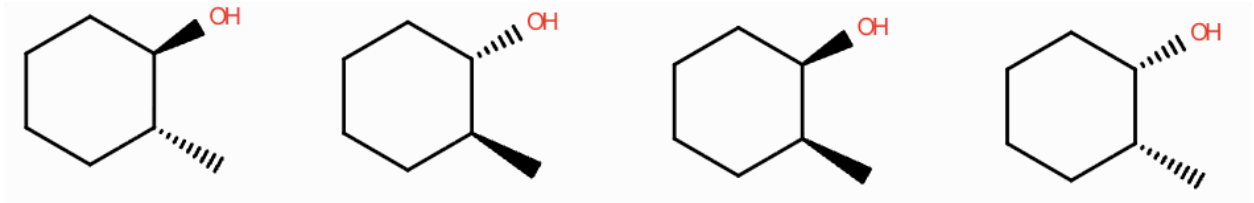
- non-superimposable not mirror images

T/F: Enantiomers have the same physical properties(boiling point, melting point and density), but diastereomers have different physical properties

(A.) True
B. False

Looking at the compounds below, identify the relationship of:

1	2	3	4



1+2: enantiomers

1+3: diastereomers

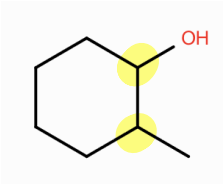
1+4: diastereomers

2+3: diastereomers

2+4: diastereomers

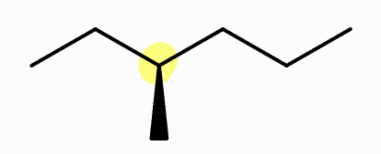
3+4: enantiomers

Calculating the maximum # of stereoisomers (be careful)



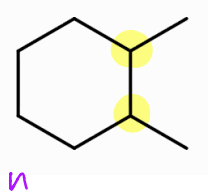
2^n

$2^2 = 4$



2^n

$2^1 = 2$



2^n

$2^2 = 4$ BUT

this compound will have a structure w/ reflectional symmetry. so the actual # of stereoisomers is 3

The method of determining which enantiomer was yielded in a reaction is:

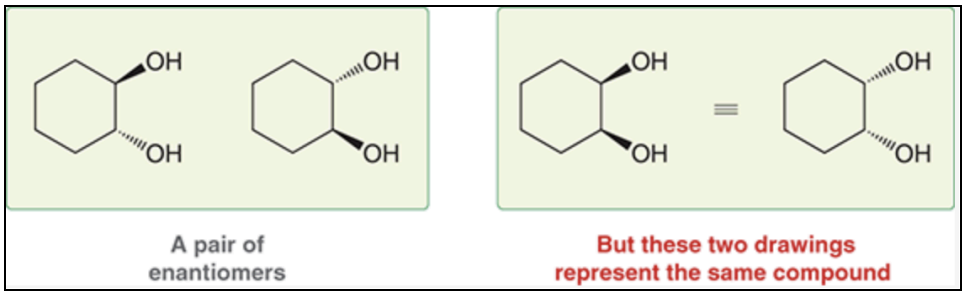
A. IR Spectroscopy
B. H-NMR
C. Polarimetry
D. Blow it up
E. C-NMR

Meso Compounds

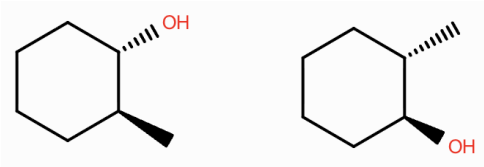
They have reflectional Symmetry

Their chiral centers are inverted (R, S)

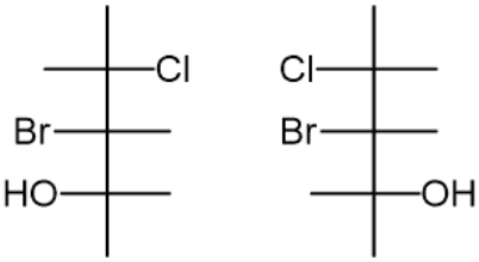
Example



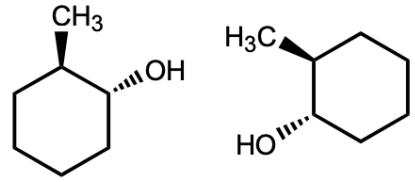
Identify the relationship of the following compounds as Meso, Enantiomer, Diasteriomer, or the same compound:



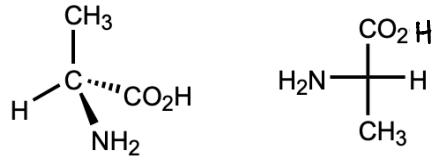
Same



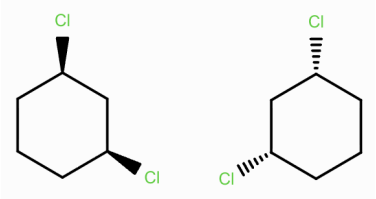
diastereomers



enantiomers

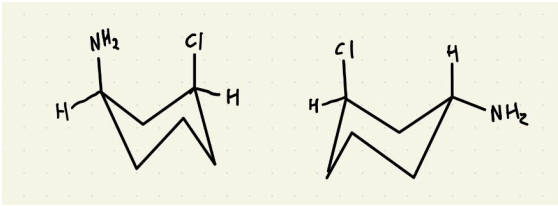


Same



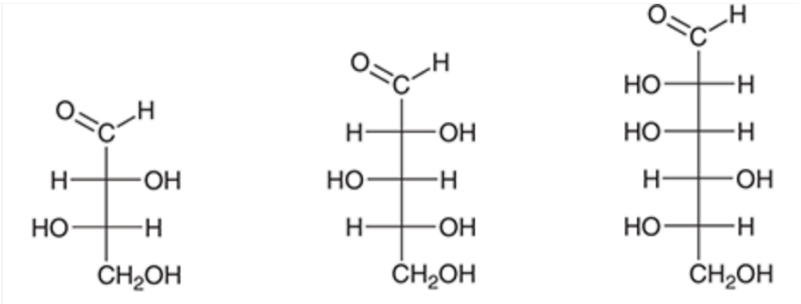
Meso

diastereomers



diastereomers

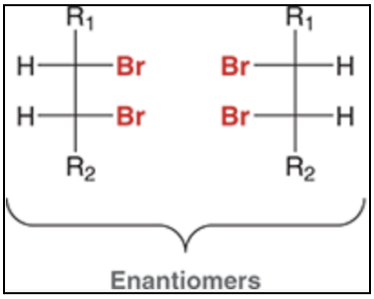
Fischer Projections

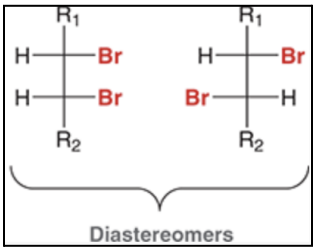


Horizontal Line = wedge

Vertical Line = dash

Example:





Assigning configuration of fischer projections

Draw one horizontal line as a wedge

Draw one vertical line as a dash

Practice: Assigning the configuration of the Fischer projection: