Stereochemistry Exam Preparation Pack

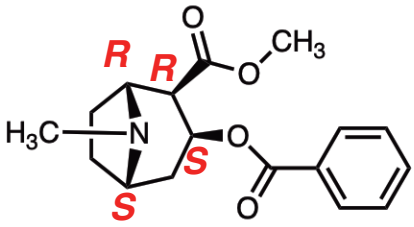
Answer Key- Advanced

note - all problems can also be found here (link)

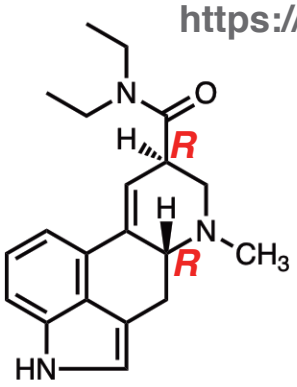
Section A: Find Chiral Centers and Determine R/S

Find the chiral centers in each of these molecules with "alternative uses" and determine *R/S* for each chiral center.

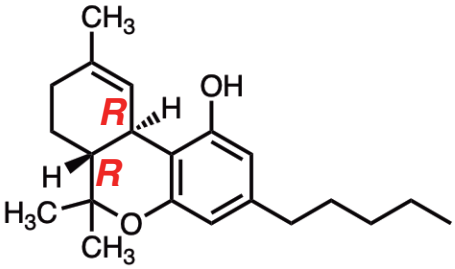
Link to answer
https://bit.ly/3F2e8Sc



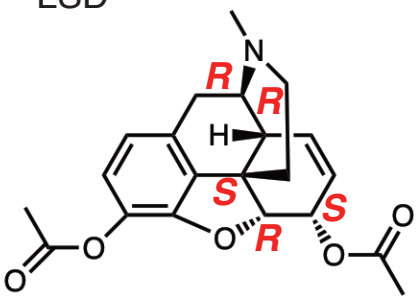
Cocaine



LSD



THC



Heroin

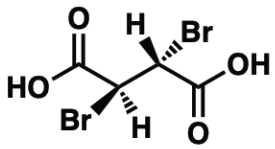
Section B: Convert to Fischer Projection

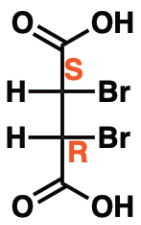
For each of the three molecules below:

- Label each chiral center as R/S
- Convert the drawing into a Fischer projection
- Draw the other stereoisomers as Fischer projections
- Indicate which of these stereoisomers is the enantiomer
- Indicate which stereoisomer(s) are diastereomers

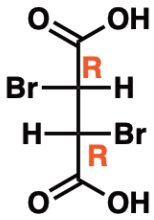
B-1 2,3-Dibromosuccinic acid

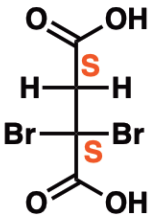
https://bit.ly/2WjbAxm





no enantiomer (meso!)

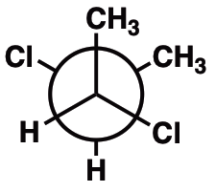


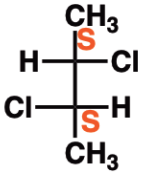


other stereoisomers (both diastereomers)

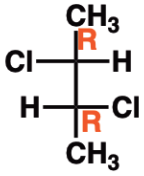
B-2 2,3-Dichlorobutane

https://bit.ly/3AUeGXJ

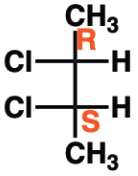




Fischer projection



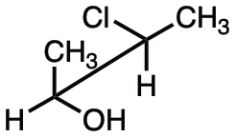
Enantiomer

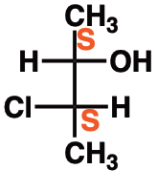


Diastereomer (meso!)

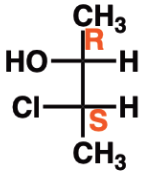
B-3 3-Chlorobutan-2-ol

https://bit.ly/3kKhoJH

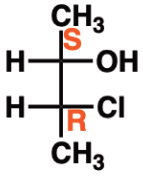




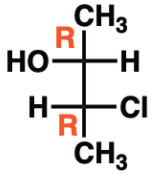
Fischer projection



Diastereomer



Diastereomer



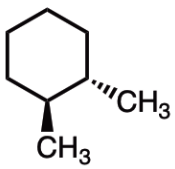
Enantiomer

Section C: Chiral or Achiral Molecules?

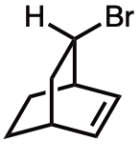
C-1 Chiral or achiral molecules?
If meso, indicate

https://bit.ly/2XWI5lm

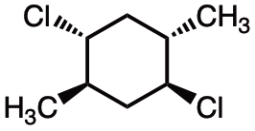
achiral
meso



chiral



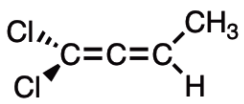
chiral



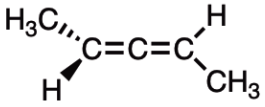
achiral
meso

C-2 Chiral or achiral molecules? If meso, indicate

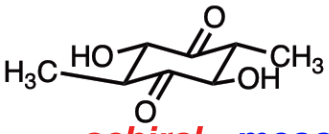
https://bit.ly/3CSBO9E



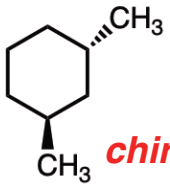
achiral



chiral



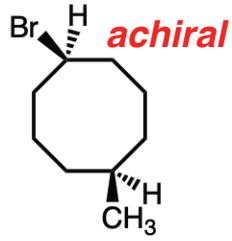
achiral ***meso***



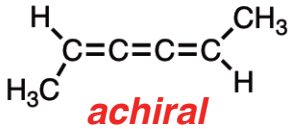
chiral

C-3 Chiral or achiral molecules? Indicate if meso

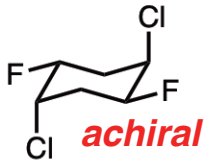
https://bit.ly/3zKH64Z



achiral



achiral

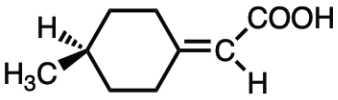


achiral
meso

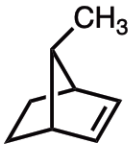
achiral

C-4 Chiral or achiral molecules? Indicate meso (if present)

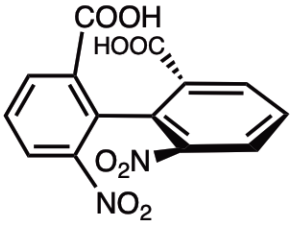
https://bit.ly/3um8DJd



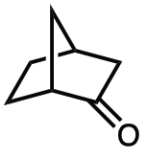
chiral



achiral



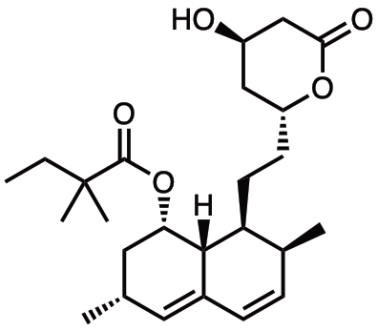
chiral



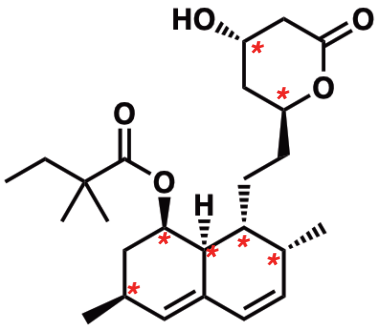
chiral

D-1 **Draw the enantiomer (+ more)** https://bit.ly/3uhaBdK

Your mission is to:
1) identify all chiral centers in Zocor
2) Draw the enantiomer
3) How many stereoisomers are possible for Zocor?



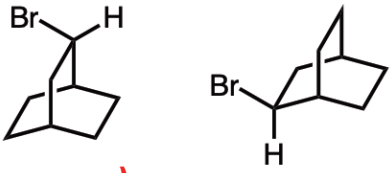
Zocor



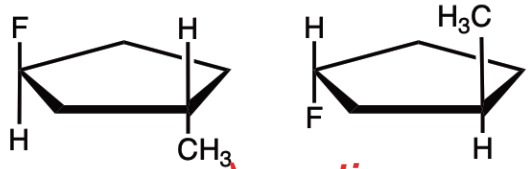
enantiomer
2^7 stereoisomers possible

E-1 **Enantiomers, Diastereomers, Constitutional Isomers, or the Same?** https://bit.ly/3AX3iuo

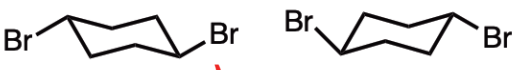
For each pair: Are these molecules enantiomers, diastereomers, the same, or constitutional isomers? Would an equal mixture of these two compounds rotate plane-polarized light?



a) same
b) yes



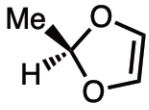
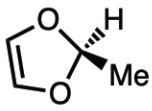
a) enantiomers
b) no



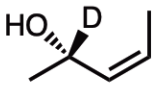
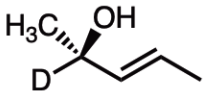
a) same
b) no

E-2 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

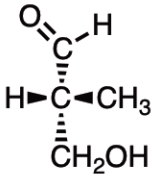
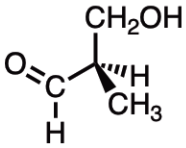
https://bit.ly/3AQwAe1

a) same
b) no

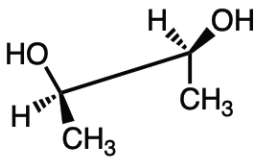
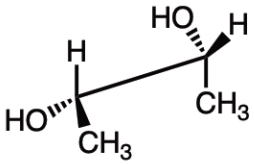
a) diastereomers
b) yes

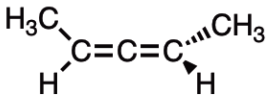
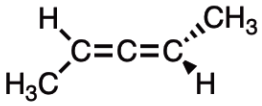
a) same
b) yes

E-3 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

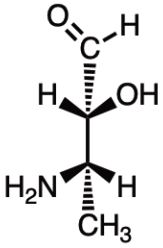
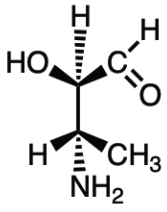
https://bit.ly/2WIZPX9

a) same
b) no

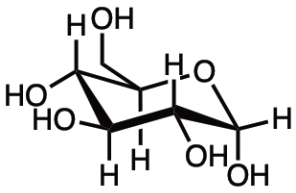
a) enantiomers
b) no

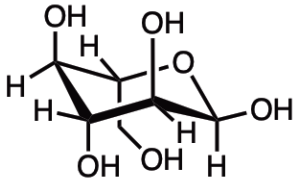



a) same
b) yes

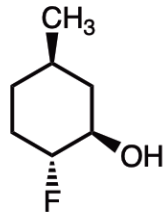
E-4 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

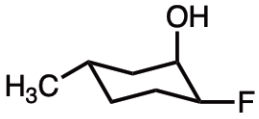
https://bit.ly/3zVJGpa



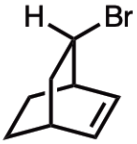


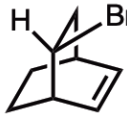
a) enantiomers
b) no





a) diastereomers
b) yes



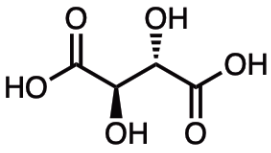


a) enantiomers
b) no

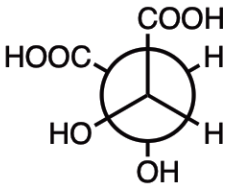
E-5 How are these three molecules (A, B, and C) related to each other?

https://bit.ly/3zVJOVG

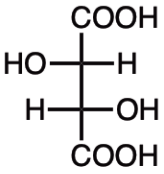
A



B



C

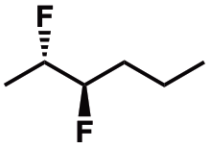


A and B: same
A and C: diastereomers
B and C: diastereomers

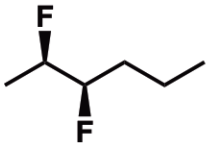
Section F: Given the name, draw the structure

a) Draw (*2S,3R*)-2,3-Difluorohexane using wedge/dash
b) Draw the diastereomers

https://bit.ly/39OwBTT

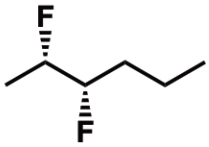


2S, 3R



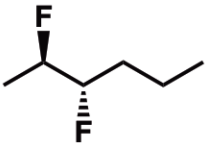
2R, 3R

diastereomer



2S, 3S

diastereomer



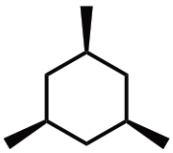
2R, 3S

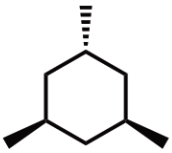
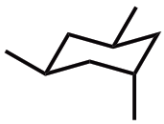
(enantiomer)

Section G, H, I: Cycloalkanes

https://bit.ly/3kPVbtM

G-1 a) Draw the two *achiral* forms of 1,3,5-Trimethylcyclohexane
b) Which is more stable?



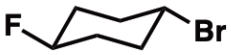



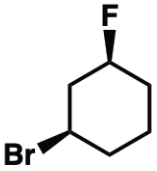
achiral #1 ***most stable chair form (most stable overall)*** ***achiral #2*** ***most stable chair form***

H-1 https://bit.ly/3kPPDzv

a) Draw the most stable **achiral** isomer of a cyclohexane with a single fluoro and a single bromo substituent on the ring

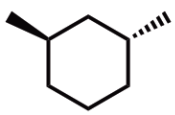
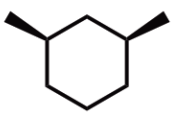
b) Draw the most stable **chiral** isomer of a cyclohexane with a single fluoro and a single bromo substituent on the ring





achiral ***most stable chair form*** ***chiral*** ***most stable chair form***

I-1 a) Draw one version of 1,3-Dimethylcyclohexane that is chiral, and one that is achiral https://bit.ly/3ATf6gZ
b) One of these isomers has two conformers of very different energy. Draw those two chair conformations.

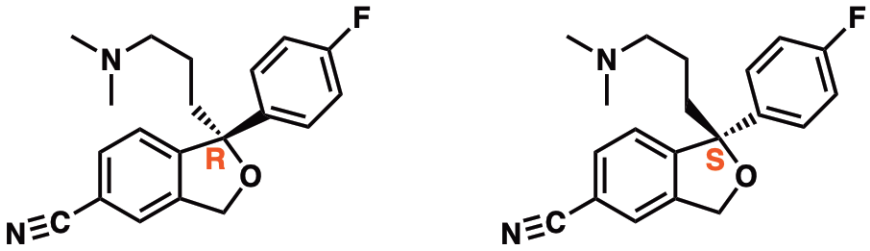




chiral ***achiral*** ***achiral has conformers of very different energy***

J-1 Draw The Enantiomer (+ more)

https://bit.ly/3kQpoZW

Escitalopram (Celexa):



enantiomer

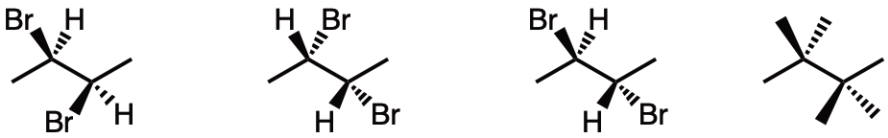
• Pure *S* enantiomer shows a specific rotation of +120°. Sven, a worker in the quality control unit, observed a specific rotation of –30° for a test sample. What is the percentage of (*R*) and the percentage of (*S*) in that sample?

62.5 % (R) 37.5 % (S)

K-1 Optical Activity

https://bit.ly/2WI9EV7

An 80:20 mixture of the (*R,R*) and (*S,S*) enantiomers of 2,3-dibromobutane has an optical rotation of –30°.
Using these templates, show the stereochemical representation of these compounds, their stereoisomers, and their optical rotations:



2R, 3R ***2S, 3S*** ***2R, 3S***

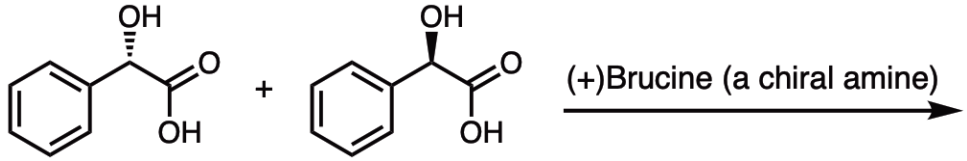
[α]: –50° **[α]: +50°** **[α]: 0° C**

L-1 Resolution

https://bit.ly/39IRIa2

Draw the two products of the following reaction, clearly showing stereochemistry (it's OK to use "R_3N" for (+)-brucine). Note that (+/–) implies a 1:1 mixture of enantiomers.

Racemic mixture of mandelic acid: reaction with (+)-Brucine



(+)-mandelic acid (–)-mandelic acid

• How are these products related to each other? ***diastereomers***
• How might you exploit this to resolve mandelic acid into its enantiomers? Describe this process briefly

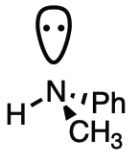
1) add (+)-brucine to racemic mixture. 2) recrystallize, and separate crystals (one diastereomer) from mother liquor, which contains other diastereomer. 3) add acid to crystals, re-forming mandelic acid, then extract in separatory funnel using water and organic solvent to separate optically active mandelic acid from the salts (can do the same for the mother liquor)

M-1 Chiral Nitrogens

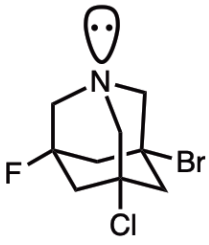
https://bit.ly/3zNGV99

Although the nitrogen in the molecule **A** below has four different substituents, the nitrogen does not give rise to a pair of enantiomers. Why not?

Would you expect the nitrogen in molecule **B** to be a chiral center? Why or why not?



A



B

constrained geometry; inversion is disfavored.
nitrogen is a chiral center

inverts rapidly, can't be separated