Master Organic Chemistry

Stereochemistry Exam Preparation Pack

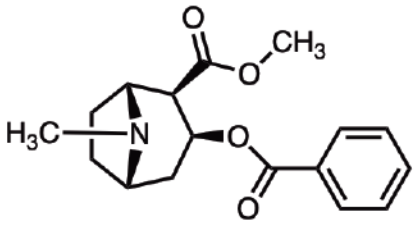
Problem Set - Advanced

Section A: Find Chiral Centers and Determine R/S

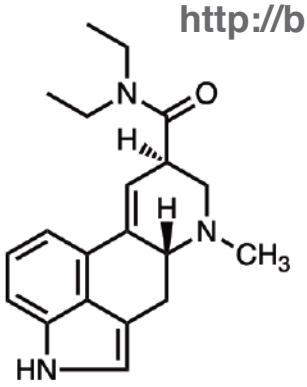
Find the chiral centers in each of these molecules with "alternative uses" and determine *R/S* for each chiral center.

Link to answer

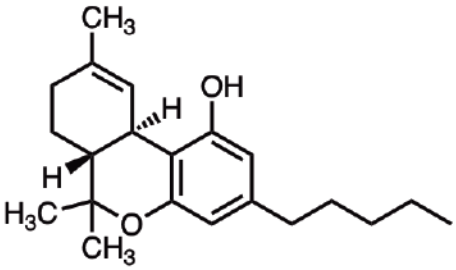
http://bit.ly/Stereochem-AD-MOC-1



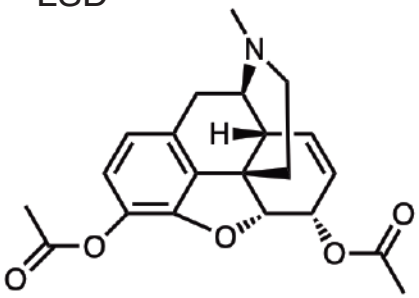
Cocaine



LSD



THC



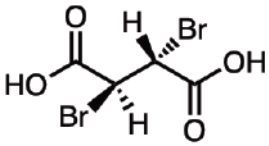
Heroin

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

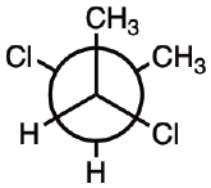
B-1



2,3-Dibromosuccinic acid

http://bit.ly/Stereochem-AD-MOC-2

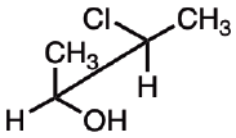
B-2



2,3-Dichlorobutane

http://bit.ly/Stereochem-AD-MOC-3

B-3



3-Chlorobutan-2-ol

http://bit.ly/Stereochem-AD-MOC-4

Section C: Chiral or Achiral Molecules?

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

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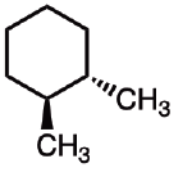

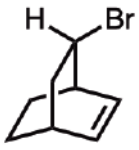

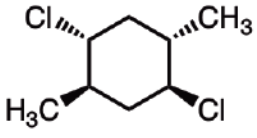

C-2 Chiral or achiral molecules? If meso, indicate

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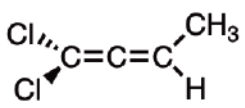

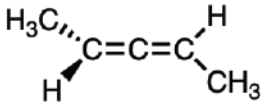

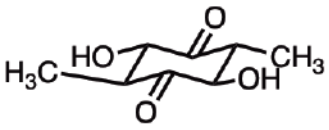

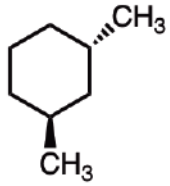

C-3 Chiral or achiral molecules? Indicate if meso

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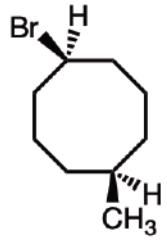

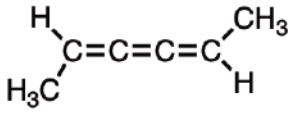

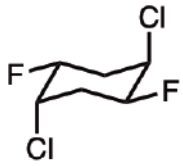

C-4 Chiral or achiral molecules? Indicate meso (if present)

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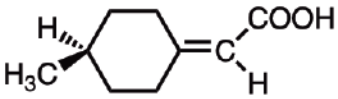
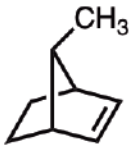
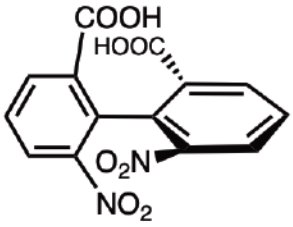
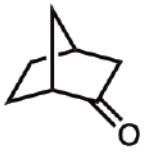




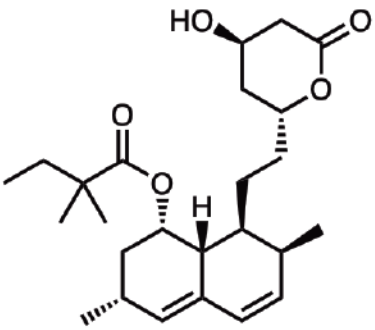




D-1 **Draw the enantiomer (+ more)** http://bit.ly/Stereochem-AD-MOC-9

In the sequel to HBO's series "Breaking Bad" entitled "Breaking Better", a rogue high school chemistry teacher clandestinely synthesizes life-saving pharmaceuticals and sells them on the black market.

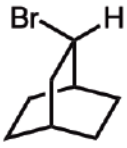
This is the structure of Zocor, a cholesterol-lowering agent that Merck has sold $24 billion worth over its patent lifetime.

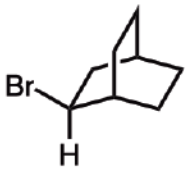


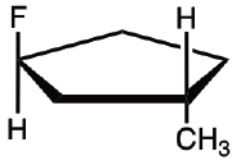
You are a production assistant for the pilot episode. Your mission is to:
1) identify all chiral centers in Zocor
2) Draw the enantiomer
3) How many stereoisomers are possible for Zocor?

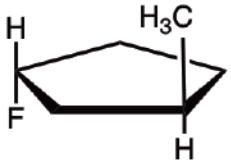
E-1 **Enantiomers, Diastereomers, Constitutional Isomers, or the Same?** http://bit.ly/Stereochem-AD-MOC-10

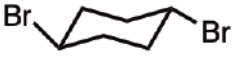
For each pair: Are these molecules enantiomers, diastereomers, the same, or constitutional isomers? Would an equal mixture of these two compounds rotate plane-polarized light?





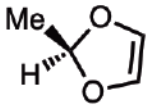


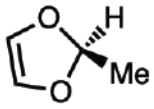


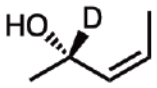


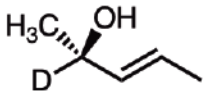
E-2 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

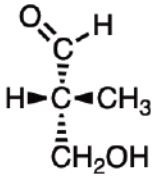
http://bit.ly/Stereochem-AD-MOC-11

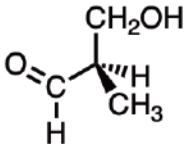












E-3 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

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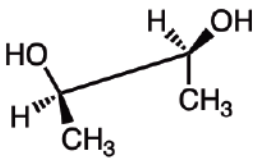
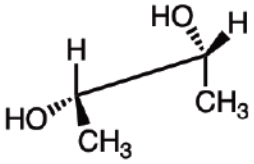
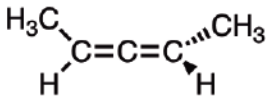
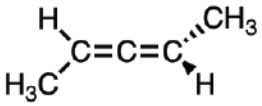
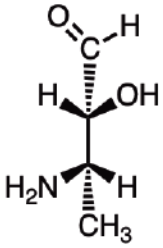
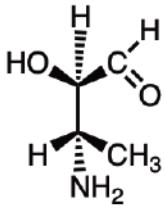






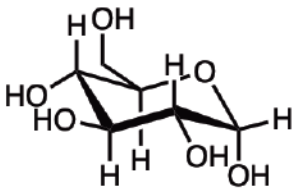


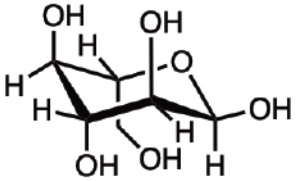


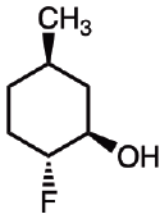


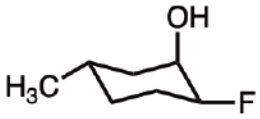
E-4 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

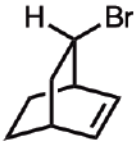
http://bit.ly/Stereochem-AD-MOC-13

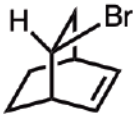








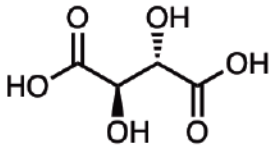




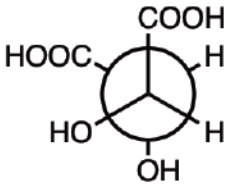
E-5 How are these three molecules (A, B, and C) related to each other?

http://bit.ly/Stereochem-AD-MOC-14

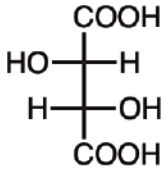
A



B



C



Section F: Given the name, draw the structure

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

http://bit.ly/Stereochem-AD-MOC-15

Section G, H, I: Cycloalkanes

http://bit.ly/Stereochem-AD-MOC-16

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

H-1 http://bit.ly/Stereochem-AD-MOC-17

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

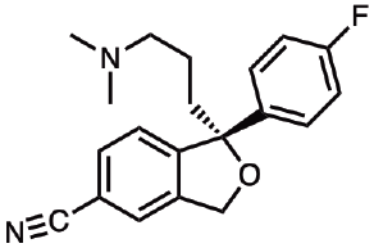
b) Draw the most stable **chiral** isomer of a cyclohexane with a single fluoro and a single bromo substituent on the ring

I-1 a) Draw one version of 1,3-Dimethylcyclohexane that is chiral, and one that is achiral http://bit.ly/Stereochem-AD-MOC-18
b) One of these isomers has two conformers of very different energy. Draw those two chair conformations.

J-1 Draw The Enantiomer (+ more)

http://bit.ly/Stereochem-AD-MOC-19

This is the molecule Escitalopram (Celexa), an antidepressant.



•Mark the stereocenter(s) and label *R/S*
• Draw the enantiomer and label *R/S*
• 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?

K-1 Optical Activity

http://bit.ly/Stereochem-AD-MOC-20

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:




2 _ 3_ 2 _ 3_ 2 _ 3_ 2 _ 3_

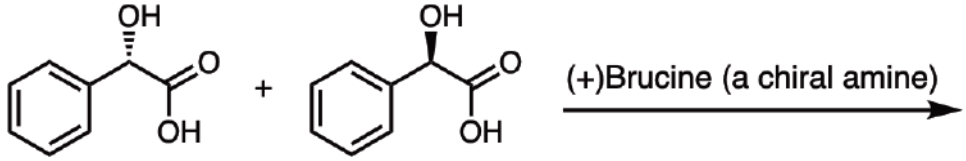
[α] : [α] : [α] : [α] :

L-1 Resolution

http://bit.ly/Stereochem-AD-MOC-21

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



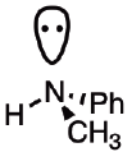
(+)-mandelic acid (–)-mandelic acid

• How are these products related to each other?
• How might you exploit this to resolve mandelic acid into its enantiomers? Describe this process (briefly! no more than 4 sentences)

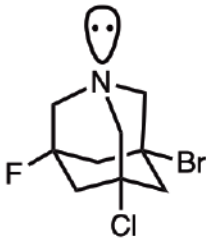
M-1 Chiral Nitrogens

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