

Stereochemistry Exam Preparation Pack

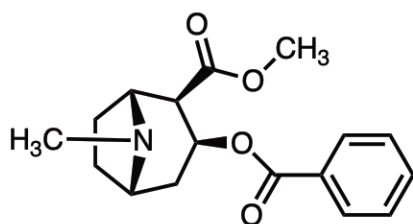
Problem Set - Advanced

Section A: Find Chiral Centers and Determine R/S

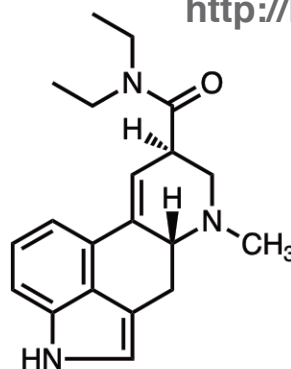
Find the chiral centers in each of these molecules with “alternative uses” and determine *R/S* for each chiral center.

Link to answer

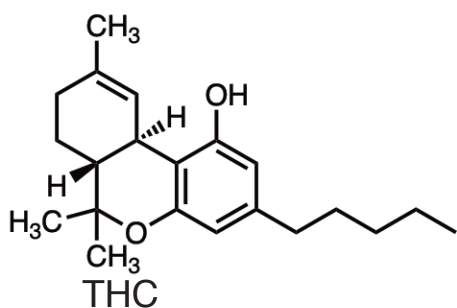
<http://bit.ly/Stereochem-AD-MOC-1>



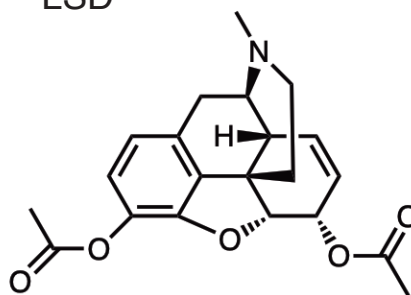
Cocaine



LSD



THC



Heroin

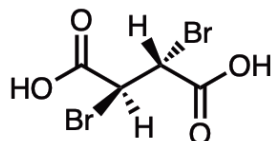


Section B: Convert to Fischer Projection

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

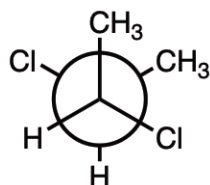


2,3-Dibromosuccinic acid

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



B-2

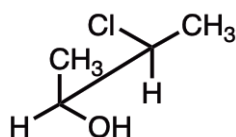


2,3-Dichlorobutane

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



B-3



3-Chlorobutan-2-ol

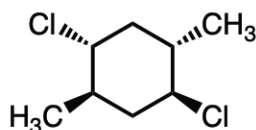
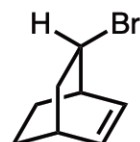
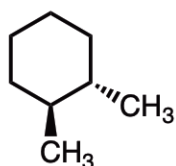
<http://bit.ly/Stereochem-AD-MOC-4>



Section C: Chiral or Achiral Molecules?

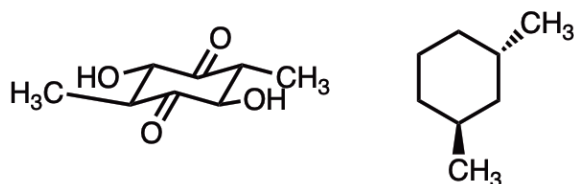
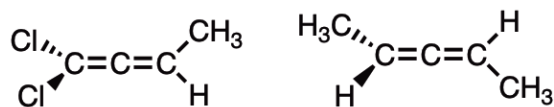
C-1 Chiral or achiral molecules?
If meso, indicate

<http://bit.ly/Stereochem-AD-MOC-5>



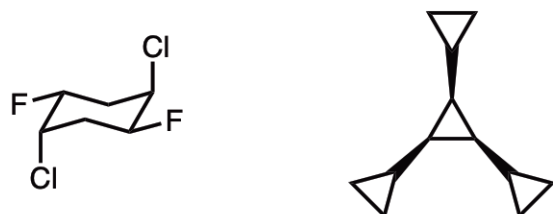
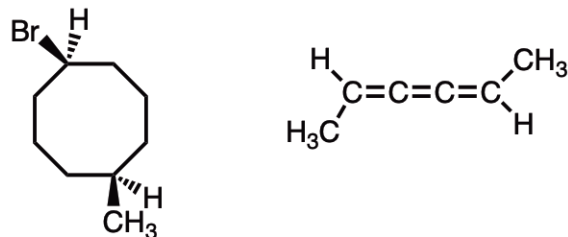
C-2 Chiral or achiral molecules? If meso, indicate

<http://bit.ly/Stereochem-AD-MOC-6>



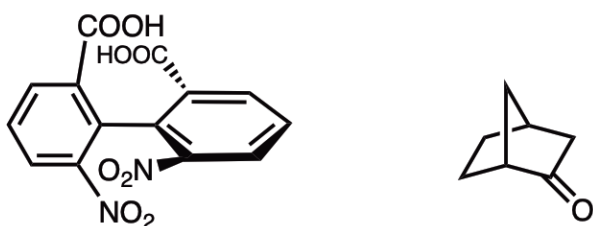
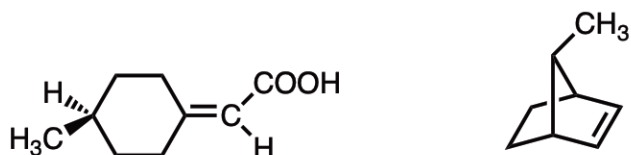
C-3 Chiral or achiral molecules? Indicate if meso

<http://bit.ly/Stereochem-AD-MOC-7>



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

<http://bit.ly/Stereochem-AD-MOC-8>

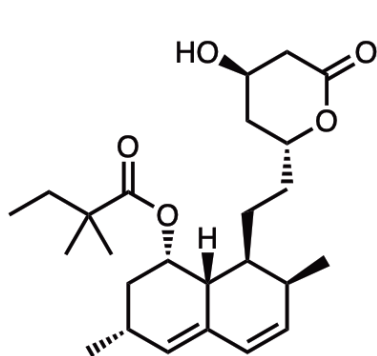


D-1 Draw the enantiomer (+ more) <http://bit.ly/Stereochem-AD-MOC-9>

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.

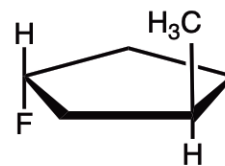
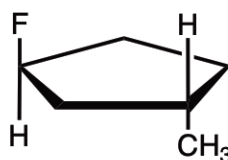
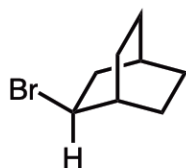
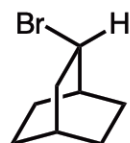


You are a production assistant for the pilot episode. Your mission is to:

- 1) identify all chiral centers in Zocor
- 2) Draw the enantiomer
- 3) How many stereoisomers are possible for Zocor?

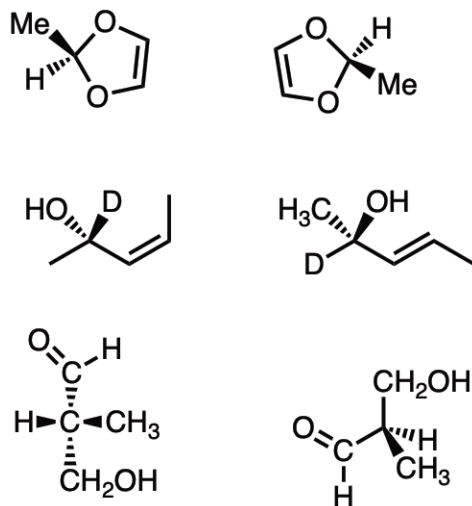
E-1 Enantiomers, Diastereomers, Constitutional Isomers, or the Same? <http://bit.ly/Stereochem-AD-MOC-10>

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?



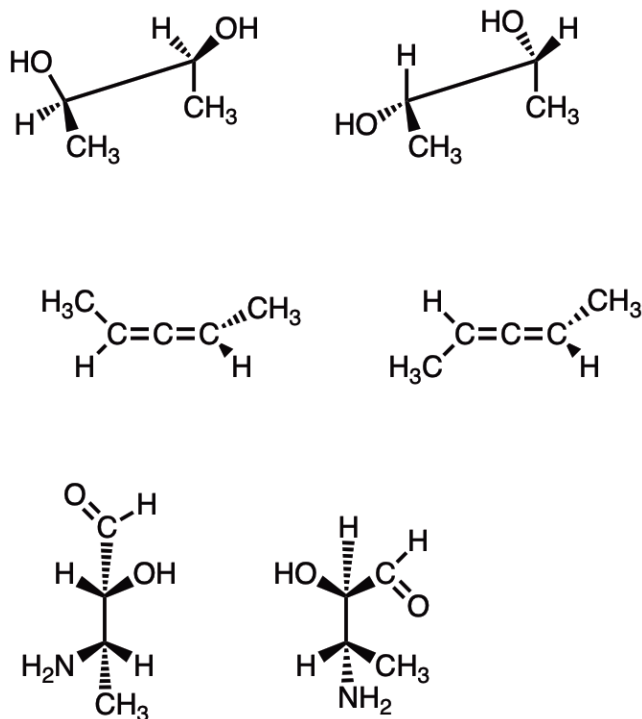
E-2 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

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



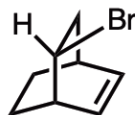
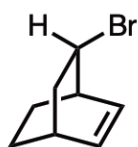
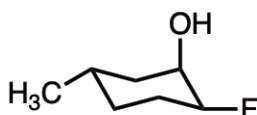
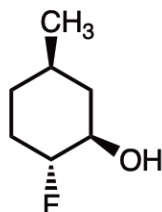
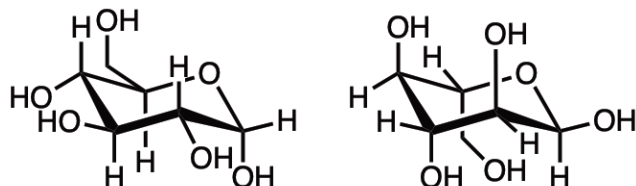
E-3 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

<http://bit.ly/Stereochem-AD-MOC-12>



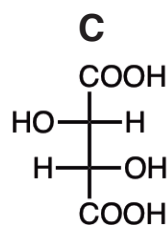
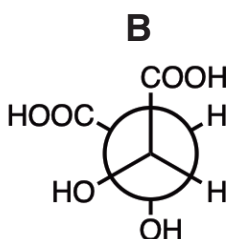
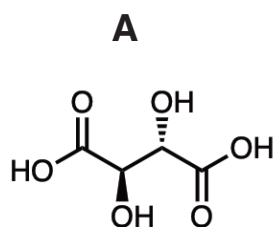
E-4 Enantiomers, Diastereomers, Constitutional Isomers, or the Same?

<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>



Section F: Given the name, draw the structure

- Draw (2*S*,3*R*)-2,3-Difluorohexane using wedge/dash
- 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
b) One of these isomers has two conformers of very different energy. Draw those two chair conformations.

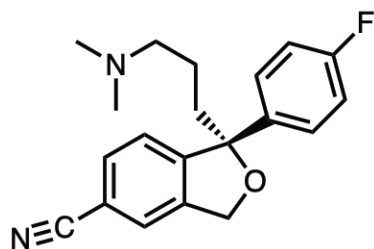
<http://bit.ly/Stereochem-AD-MOC-18>



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 $+120^\circ$. 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 _

$[\alpha]$:

2 _ 3 _

$[\alpha]$:

2 _ 3 _

$[\alpha]$:

2 _ 3 _

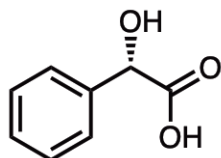
$[\alpha]$:

L-1 Resolution

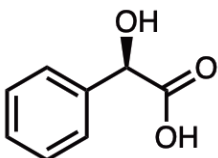
<http://bit.ly/Stereochem-AD-MOC-21>

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



+



(+)-Brucine (a chiral amine)



(+)-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?

