Stereochemistry Exam Preparation Pack
Problem Set - Advanced

note - all problems can also be found [here](https://www.masterorganicchemistry.com) (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.

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
Stereochemistry Problem
Set - Advanced

B-1
2,3-Dibromosuccinic acid

B-2
2,3-Dichlorobutane

B-3
3-Chlorobutan-2-ol

Section C: Chiral or Achiral Molecules?

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

https://www.masterorganicchemistry.com
C-2  Chiral or achiral molecules? If meso, indicate

C-3  Chiral or achiral molecules? Indicate if meso

C-4  Chiral or achiral molecules? Indicate meso (if present)
D-1  **Draw the enantiomer (+ more)**  https://bit.ly/3uhaBdK

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.

![Zocor Structure](https://bit.ly/3uhaBdK)

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?**  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?

![Diagram](https://bit.ly/3AX3iuo)
E-2  Enantiomers, Diastereomers, Constitutional Isomers, or the Same?  
https://bit.ly/3AQwAe1

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

E-4

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

a) Draw (2S,3R)-2,3-Difluorohexane using wedge/dash

b) Draw the diastereomers

E-5

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

Section F: Given the name, draw the structure

a) Draw (2S,3R)-2,3-Difluorohexane using wedge/dash
b) Draw the diastereomers
Section G, H, I: Cycloalkanes

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

H-1

   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.  

J-1 Draw The Enantiomer (+ more)  
   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

An 80:20 mixture of the \((R,R)\) and \((S,S)\) enantiomers of 2,3-dibromobutane has an optical rotation of \(-30^\circ\).

Using these templates, show the stereochemical representation of these compounds, their stereoisomers, and their optical rotations:

\[
\begin{array}{ccc}
\text{2} & \text{3} & \text{2} \\
\text{[\(\alpha\):]} & \text{[\(\alpha\):]} & \text{[\(\alpha\):]}
\end{array}
\]

L-1 Resolution

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

\[
\text{(+)mandelic acid} + \text{(-)-mandelic acid}
\]

• 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?