Organic Chemistry I, CHM 3140
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Chapter 5 Stereochemistry, Part 3 – Practice Problems

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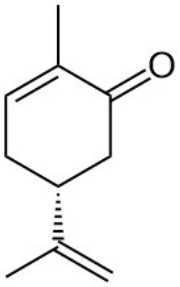
1

Does the following drawing represent *R* or *S* carvone? Draw its enantiomer using two methods.

(*R*)-carvone or
(*S*)-carvone?



Draw mirror image:

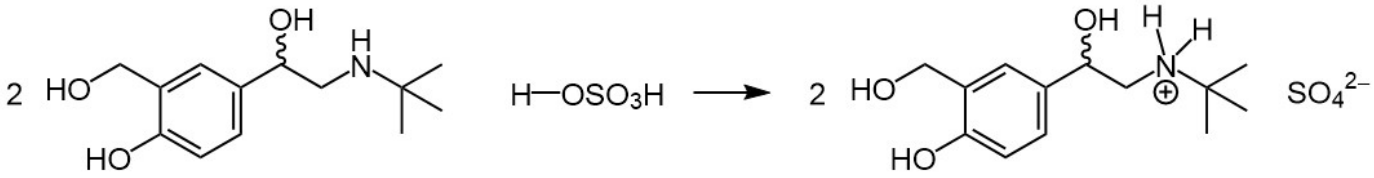
Invert all chiral centers:

(*R*)-carvone smells/tastes like spearmint, and **(*S*)-carvone** like caraway seeds (used in rye bread). What does that tell you about the odor receptors in your nose and taste receptors in your mouth?

2

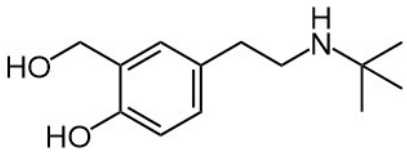
Albuterol is a bronchodilator that treats asthma when delivered by an inhaler.
The drug is marketed as a racemic mixture of its sulfate salt (formed by reaction with H_2SO_4).

Provide a mechanism to show albuterol reacting with a strong acid such as sulfuric acid.
Note: sulfuric acid is diprotic so one molecule of sulfuric acid can protonate two molecules albuterol.

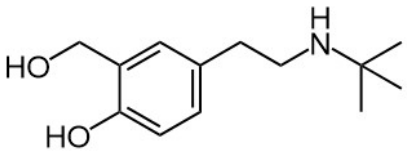


(±)-albuterol sulfuric acid (±)-albuterol sulfate
(H-albuterol$^+$ SO_4^{2-})

Complete the drawings below to draw (*R*)-(−)-albuterol and (*S*)-(+)-albuterol.



(*R*)-(−)-albuterol



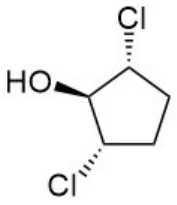
(*S*)-(+)-albuterol

The enantiomer with the pharmacological activity is marketed as a different drug, called *levalbuterol*. Do you think levalbuterol is the *R* or *S* enantiomer of albuterol? Explain.

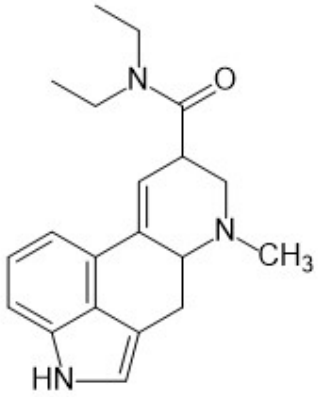
3

An asymmetric synthesis of albuterol resulted in a mixture that was 75% (*R*) and 25% (*S*). What is the expected specific rotation of this mixture? Albuter$^{D}_{20}$ [α] −32.2° (c = 0.1 in water)

4 Determine whether or not each of the following is optically active.

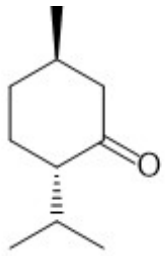
a molecule with one chiral center	(+)-Starkyne	racemic tartaric acid	

5 Identify all the chiral centers in lysergic acid diethylamide (LSD). Mark each with *.
LSD has how many possible stereoisomers?



lysergic acid diethylamide (LSD)

6 Shown below is menthone, a minor component of peppermint oil. Determine the configuration of each chiral center in menthone, draw its enantiomer, and predict its specific rotation and boiling point.

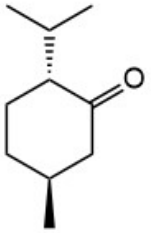


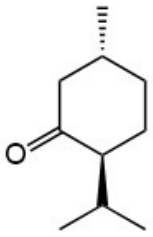
menthone
$[\alpha]_D^{20}$ -25°
bp 207°C

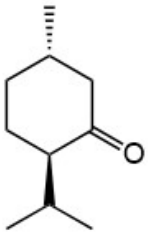
enantiomer
of menthone
$[\alpha]_D^{20}$

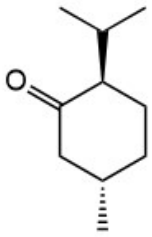
bp

Identify the drawing that does NOT represent the **enantiomer** of menthone.

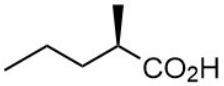
A) 

B) 

C) 

D) 

7 Which of the following statements is NOT true about a given sample of (R)-acid that has a specific rotation $[\alpha] = -45$ and 90% ee?



(R)-acid

90% ee sample of (R)-acid has $[\alpha] = -45$

A) The sample is optically active.

B) Pure (R)-acid would have $[\alpha] = -50$.

C) The sample contains 90% (R) enantiomer and 10% racemic mixture.

D) The sample contains 95% (R) enantiomer and 5% (S) enantiomer.

E) The (S)-acid enantiomer is levorotatory.