**Organic Chemistry I,CHM 3140**
**Dr. Laurie S. Starkey, Cal Poly Pomona**
**Exam II Review – Practice Problems**

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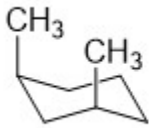
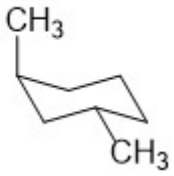
text LAURIESTARKE263 to 37607

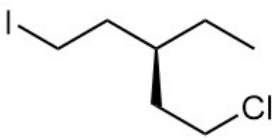
**1** Which isomer is more thermodynamically stable (*i.e.* has a lower heat of combustion), *cis* or *trans* 1,3-dimethylcyclohexane? Explain.



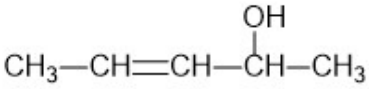




**2** Predict the direction of the equilibrium (forward, reverse or neither).
*Hint: consider Newman projections.*


**3** Which is the correct IUPAC name for the given compound?



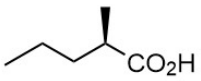

**4** Draw all stereoisomers of the given compound. How many stereoisomers are there, in total?




A) 1
B) 2
C) 3
D) 4

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

**5**




(R)-acid

90% ee sample of (R)-acid has [α] = −45

A) The sample is optically active.

B) Pure (R)-acid would have [α] = −50.

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

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

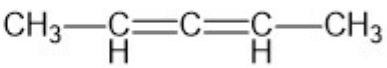
E) The (S)-acid enantiomer is levorotatory.

**6** Determine whether or not each compound below is optically active. Explain.

*trans*-1,3-diisopropylcyclobutane

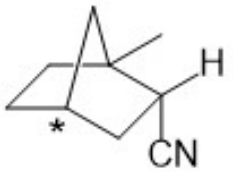
*trans*-1,2-diisopropylcyclobutane

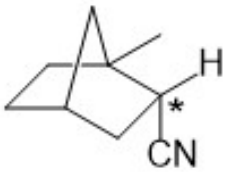
**7** Determine whether or not each compound below has an enantiomer. Explain.

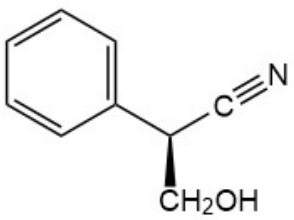




What is the configuration of the marked (*) carbon?

**8**



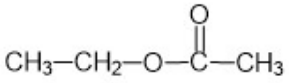

A) R

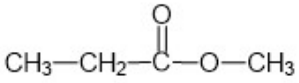
B) S

C) neither

Which would be better to distinguish the following compounds, $^{1}H$ or $^{13}C$ NMR (or are they equally suitable)? Explain, and describe the difference(s) to look for.

**9**

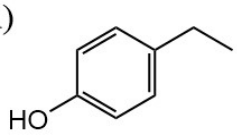




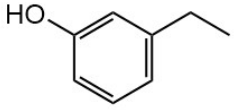
**10** Which compound gives the following $^{1}H$ NMR spectrum?

(Klein text problem 15.75)

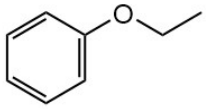

A)



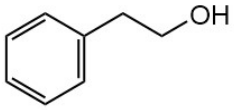
B)



C)

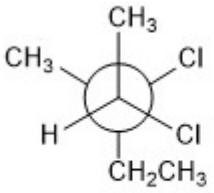


D)

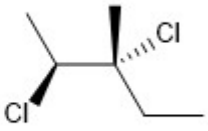


**11** What is the relationship of the following pairs of compounds?

A) constitutional isomers
B) enantiomers
C) diastereomers
D) the same compound
E) unrelated



1

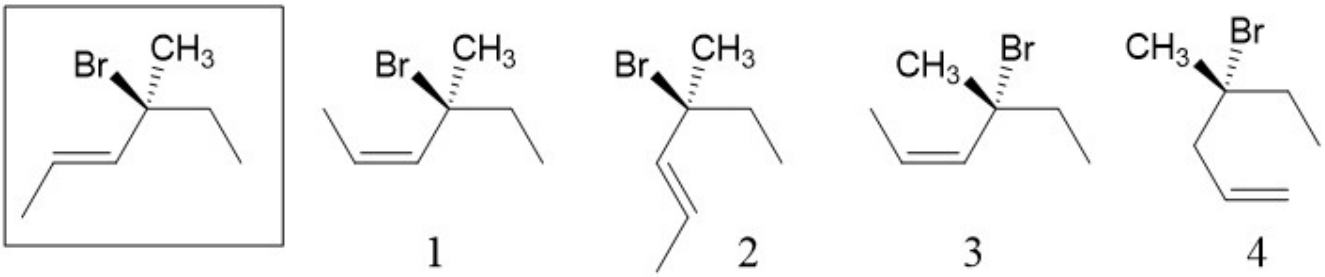


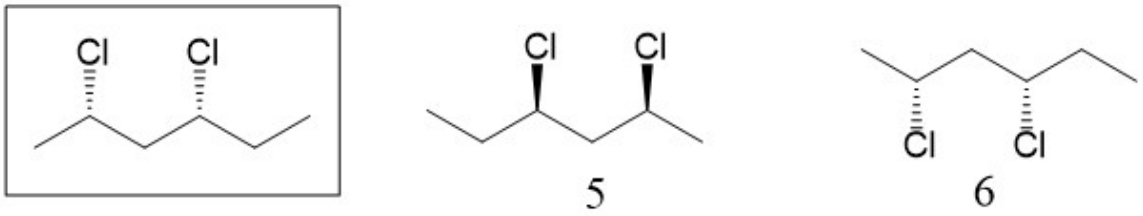
2

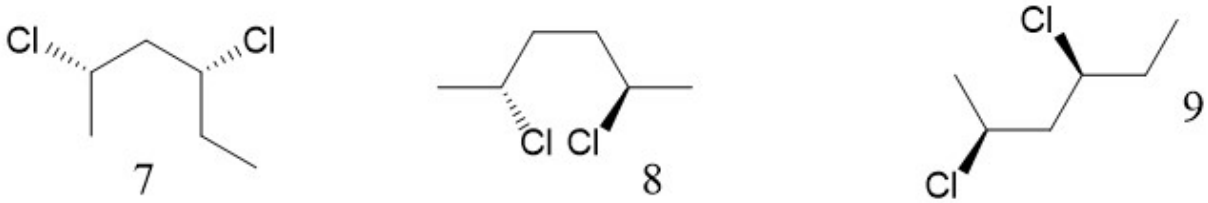
What is the IUPAC name of compound **1**?
Be sure to include stereochemistry.

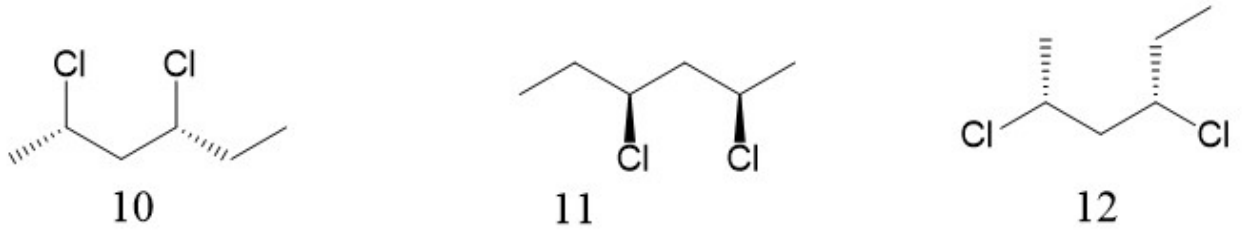
**12** What is the relationship of the following pairs of compounds? (Compare the structure in each box to the other drawings.)

A) constitutional isomers
B) enantiomers
C) diastereomers
D) the same compound
E) unrelated



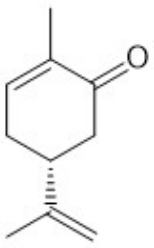




Group work: Draw the enantiomer of the given structure (*R* or *S* carvone?) using two methods.

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

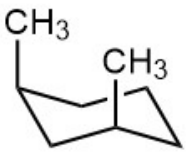
Draw mirror image:

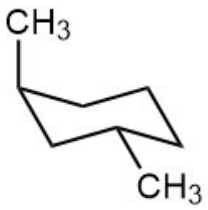
Invert all chiral centers:




(*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?

**1** Which isomer is more thermodynamically stable (*i.e.*, has a lower heat of combustion), *cis* or *trans* 1,3-dimethylcyclohexane?




A) The cis isomer is more stable, because it has more 1,3-diaxial interactions.

B) The trans isomer is more stable, because the methyl groups are farther apart.

C) The cis isomer is more stable, because both methyl groups can be in equatorial positions.

D) The trans isomer is more stable because, trans has less steric strain.

**2** Determine the direction of the equilibrium (forward or reverse favored?). Explain briefly.


A) **Forward** is favored because the conformation on the right has no gauche interactions.

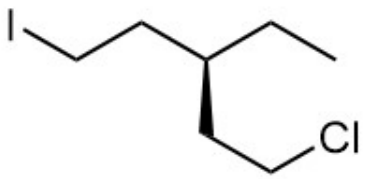
B) **Reverse** is favored because the conformation on the left has greater symmetry.

C) **Forward** is favored because the staggered conformation is lower in energy.

D) **Reverse** is favored because the staggered conformation is lower in energy.

E) Neither direction is favored, because they are the same compound.

3 Which is the correct IUPAC name for the given compound?




A) 1-iodo-3-ethyl-5-chloropentane

B) 1-iodo-3-propyl-6-chlorohexane

C) 1-chloro-3-ethyl-5-iodopentane

D) 1-chloro-3-propyl-6-iodohexane

E) 1-iodo-3-methyl-6-chlorohexane

A) R

B) S

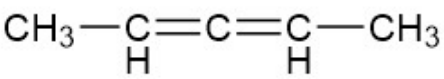
C) neither

6 Determine whether or not each compound below is optically active.

| | *trans*-1,3-diisopropylcyclobutane | *trans*-1,2-diisopropylcyclobutane |
|---|---|---|
| A) | optically active | optically active |
| B) | optically active | optically inactive |
| C) | optically inactive | optically active |
| D) | optically inactive | optically inactive |

7

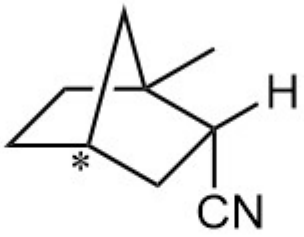
Determine whether or not each compound below has an enantiomer.



| | | |
|---|---|---|
| A) | Yes, it has an enantiomer. | No, there is no enantiomer. |
| B) | No, there is no enantiomer. | No, there is no enantiomer. |
| C) | Yes, it has an enantiomer. | Yes, it has an enantiomer. |
| D) | No, there is no enantiomer. | Yes, it has an enantiomer. |

What is the configuration of the marked (*) carbon?

8a



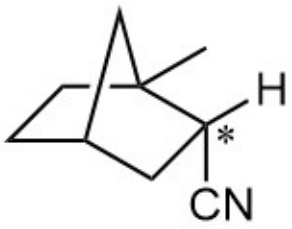

A) R

B) S

C) neither

What is the configuration of the marked (*) carbon?

**8b**



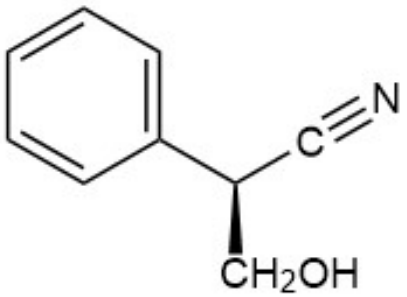

A) R

B) S

C) neither

**8c**

What is the configuration of the molecule shown?

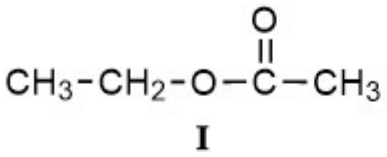



A) R

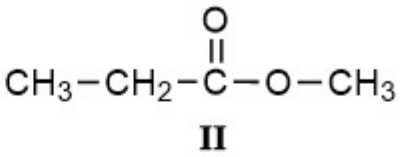
B) S

C) neither

**9** How could you use $^1$H NMR to distinguish between the given compounds?



**I**



**II**

A) I has a triplet ~3.8 ppm and singlet ~2.2 ppm.

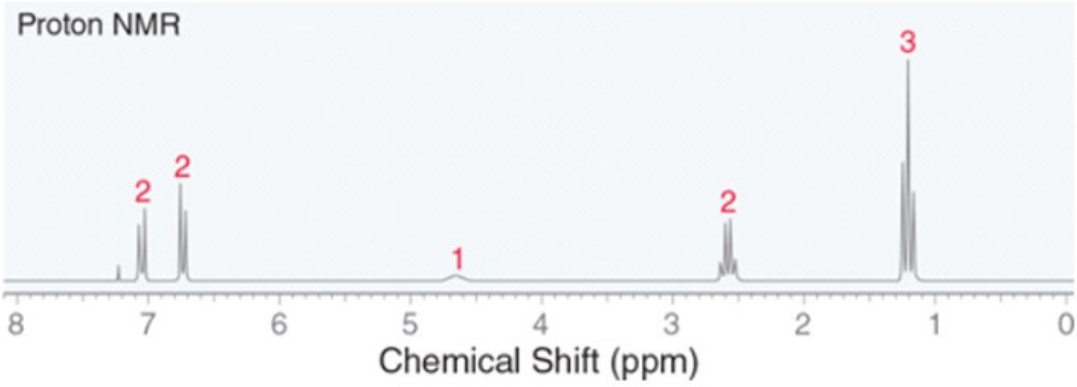
B) I has a quartet ~3.8 ppm and triplet at ~2.2 ppm.

C) The signal ~3.8 is a quartet for I and a singlet for II.

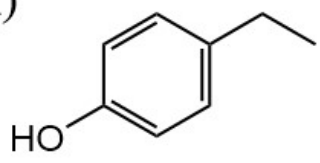
D) II has a singlet ~3.8 ppm and triplet at ~2.2 ppm.

E) II has a triplet ~3.8 ppm and quartet at ~2.2 ppm.

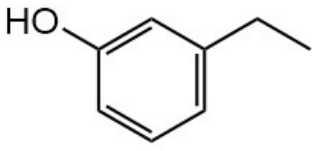
**10** Which compound gives the following $^1$H NMR spectrum? (Klein text problem 15.75)



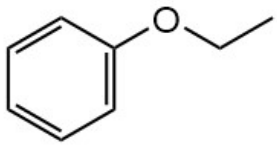

A)



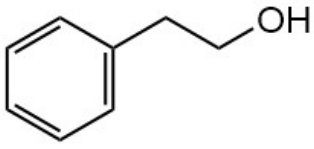

B)



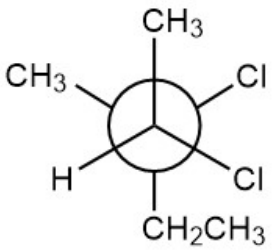

C)




D)



**11** Which is the correct IUPAC name for the given compound?




A) 2,3-dichloro-3-methylbutane

B) 2,3-dichloro-2,3-dimethylpentane

C) 2,3-dichloro-3-methylpentane

D) 2,3-dichloro-2,3-dimethylbutane

Configuration

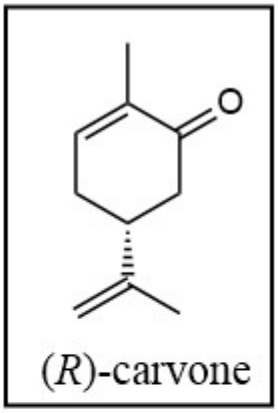
A) (2*R*,3*R*)

B) (2*R*,3*S*)

C) (2*S*,3*R*)

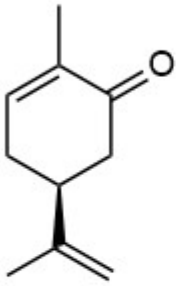
D) (2*S*,3*S*)

**13** Identify the drawing that does NOT represent the **enantiomer** of (*R*)-carvone.

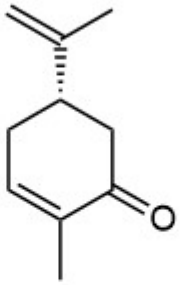



(*R*)-carvone

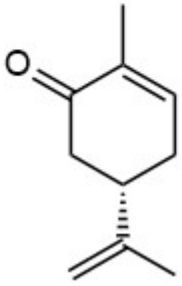
A)




B)




C)




D)