

Comprehensive Organic Chemistry - Chem 225b

Problem Set 4

Chapter 5

Due: Monday, February 18, 2008

The Borromeo Rings

Versions of this symbol date to the time of the Vikings. In the 15th century, it was apparently the symbol of a tripartite alliance of the Milanese families Visconti, Sforza and Borromeo via intermarriage. Break any (wedding?) ring and the others separate hence the



separate, hence the alliance is broken. The rings form a [chiral object](#) (left) that are not superimposable on their [mirror image](#). A set of Borremean rings has been used as the logo for a certain refreshment that extols purity, body, and flavor. Is the sense of chirality of the two sets of Borremean rings the same or different? For some other discourses on chirality, see:

[Potpourri](#)

[The Figure 8 Knot](#)

[Gentlemen's Neckties](#)

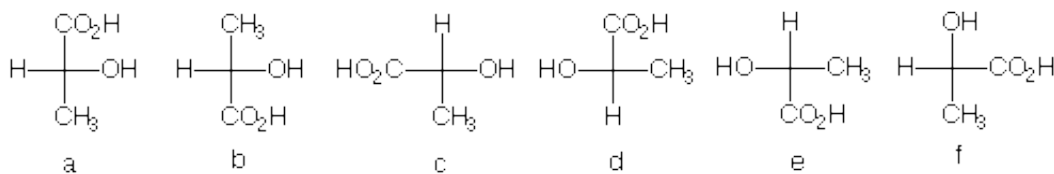


Read the [stereoisomers module](#) in the StudyAids and do the exercises. There is no need to record answers on your homework.

Don't forget the [Chirality of Shells](#) (Powerpoint).

1. When (*R*)-sec-butylbenzene, a.k.a 2-phenylbutane, undergoes free radical chlorination, four monochloro constitutional isomers are formed, the phenyl ring remaining intact. What are these structures? Draw them. Be explicit as to diastereomers, enantiomers, racemates, etc.

2. There are twelve possible Fischer projections for a given enantiomer of lactic acid. Why? (*S*)-(+)-Lactic acid, the alleged cause of cramping after vigorous physical exercise, was isolated from human muscle by [Berzelius](#). Which of the following Fischer projections represent (*S*)-(+)-lactic acid?

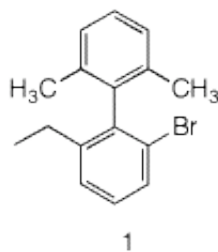


3. A mixture of enantiomers has $[\alpha]_D = -78^\circ$. If the rotation of the pure dextrorotatory enantiomer is $[\alpha]_D = 104^\circ$, what is the composition of the mixture?

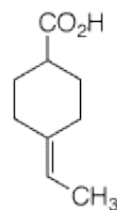
4. a) 1,2-Dibromoethane is optically inactive yet it has a dipole moment. Explain and illustrate.

b) meso-Tartaric acid exists in three staggered conformations, none of which has a [plane of symmetry](#). Yet the compound is optically-inactive. Explain and illustrate.

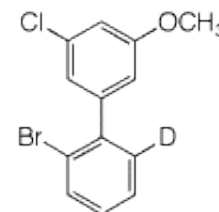
5. Which of the compounds on the right are, in principle, capable of resolution? Explain and illustrate.



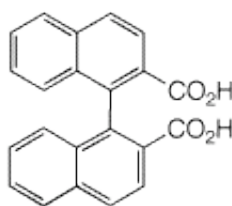
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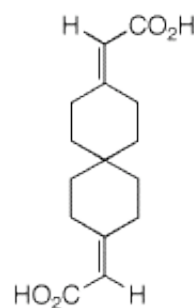
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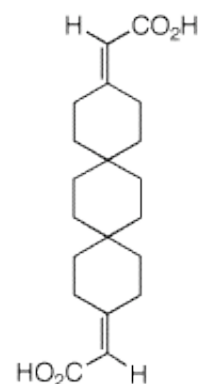
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