uc3m | Universidad Carlos III de Madrid

OpenCourseWare (2023)

CHEMISTRY II

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EXERCISES OF STEREOCHEMISTRY

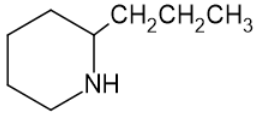
Exercise 1. Draw a qualitative potential-energy diagram for rotation about the C3-C4 bond in 2-methylpentane. Show Newman projections for all conformations located at the maximum and minimum points on your graph**.**

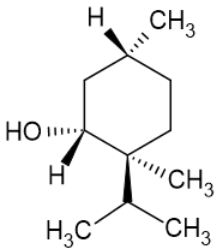
Exercise 2. Arrange the following conformations of 1,2-ethanediol in order of stability. Name the conformations using the prefixes *anti*, *syn*, and the suffixes *periplanar* and *clinal*.

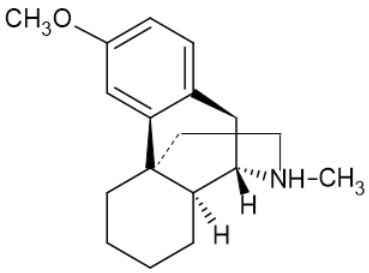
Exercise 3. Draw the expected potential-energy diagram for the rotation about the C2-C3 bond in 2,3-dimethylbutane. Include the Newman projections of each staggered and eclipsed conformation.

Exercise 4. Which of the following molecules are chiral? Identify the chirality center(s) in each.

(a) (b) (c)







Coniine Menthol Dextromethorphan

(poison hemlock) (flavoring agent) (cough suppressant)

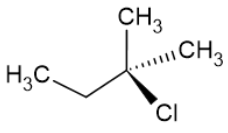
Exercise 5. Consider 2-methylbutane (isopentane). Sighting along the C2-C3 bond:

(a) Draw a Newman projection of the most stable conformation.
(b) Draw a Newman projection of the least stable conformation.
(c) If a $CH_3 \leftrightarrow CH_3$ eclipsing interaction costs 11 kJ/mol, a $H \leftrightarrow H$ eclipsing interaction costs 4.0 kJ/mol, a $CH_3 \leftrightarrow H$ eclipsing interaction costs 6.0 kJ/mol, and a $CH_3 \leftrightarrow CH_3$ gauche interaction costs 3.8 kJ/mol, make a quantitative plot of energy versus rotation about the C2-C3 bond.

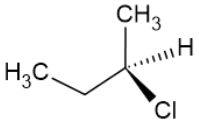
Exercise 6. Draw a tetrahedral representation of (*S*)-2-pentanol-(2-hydroxypentane).

Exercise 7. Below are four compounds. Which two compounds are enantiomers of each other?

1)



2)



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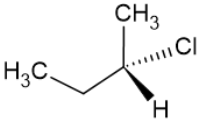

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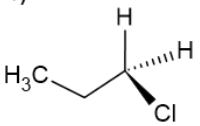
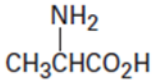
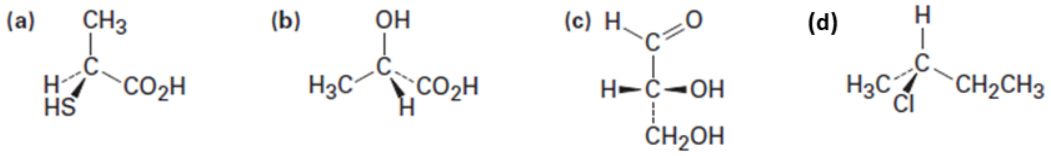


Exercise 8. Alanine, an amino acid present in proteins, is chiral; draw the two enantiomers of alanine using the standard convention of solid, wedge, and dashed lines, and identify the R and S enantiomer.



Alanina

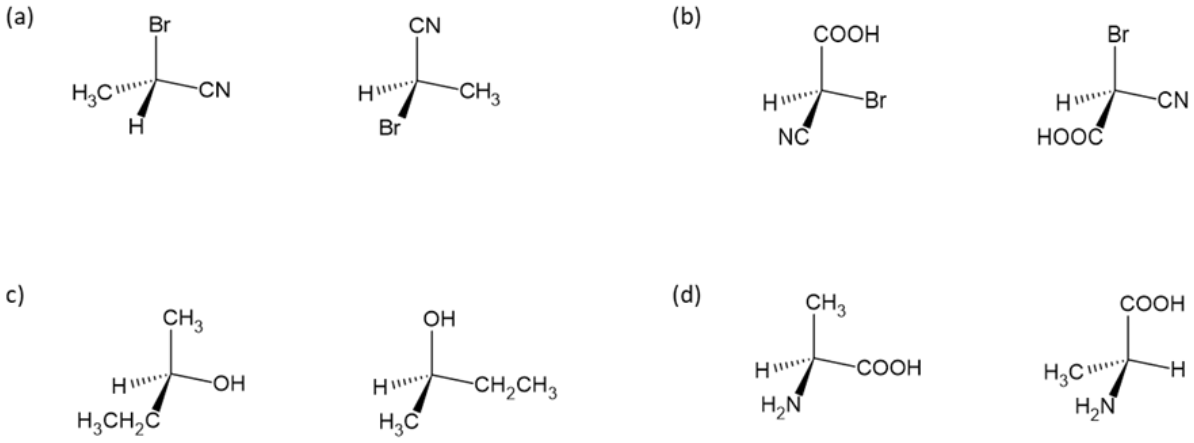
Exercise 9. Assign R or S configuration to the chiral center in each of the following molecules. Name them according to the IUPAC nomenclature.



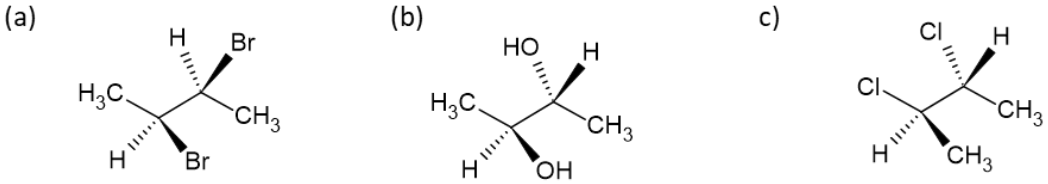
Exercise 10. Draw tetrahedral representations of the following molecules:

(a) (2*S*)-2-chlorobutane
(b) (3*R*)-3-chloropent-1-ene
(c) (1S)-1-chloropropan-1-ol

Exercise 11. Which of the following pairs of structures represent the same enantiomer and which represent different enantiomers? Name them according to the IUPAC nomenclature.

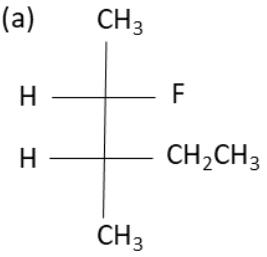


Exercise 12. Assign *R* or *S* configuration to each chirality center and give IUPAC name in the following molecules:

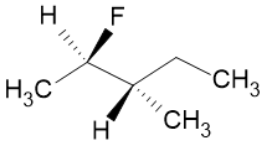


Exercise 13. What are the stereochemical relations (identical, enantiomers, diastereomers) of the following four molecules? Assign absolute configurations at each stereocenter.

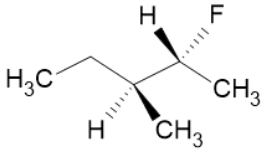
(a)



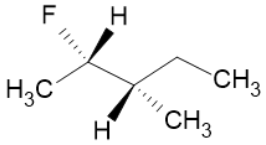
(b)



(c)



(d)



Exercise 14. Draw the possible stereoisomers of 2-bromo-3-chlorobutane and establish the relationship between them. Use line-bond (Hashed-wedged line) and Fisher representations.

Exercise 15. Draw the possible stereoisomers of 2,3 dibromobutane and establish the relationship between them. Use line-bond (Hashed-wedged line) and Fisher representations.

IMAGE CREDITS

- Images of all exercises were made by authors.