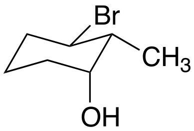
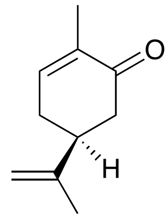
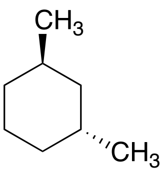
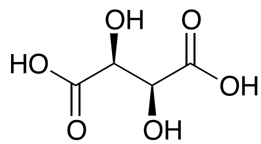
Homework 4

Organic Chemistry I (CHM 221/223) • Prof. Chad Landrie

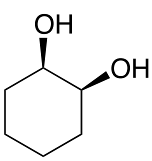
Score (4 pts)		Lectures	8, 9	Name	

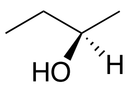
1. Draw the enantiomer for each of the following molecules.

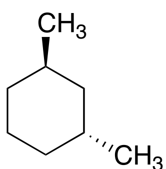
			
			

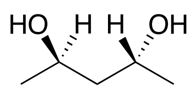
2. Label each chirality center in your drawn molecules above and the original molecules above as *R* or *S*.

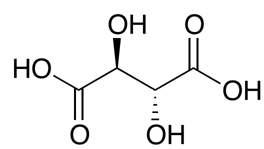
3. Circle the molecules below that are meso.

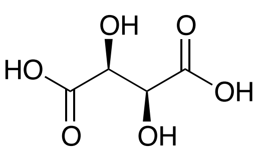


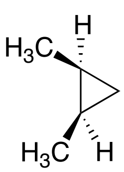


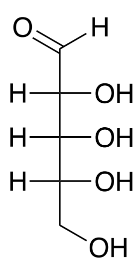


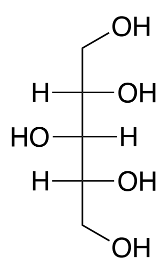


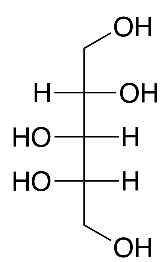






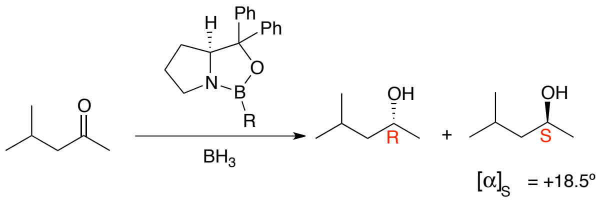






4. Define meso. Are meso compounds optically active? Why or why not?

5. Ketones can be reduced to alcohols enantioselectively (one enantiomer is preferred) by using a chiral catalyst such as the one shown below. If the specific optical rotation for the product mixture formed by this reduction was –12.0°, what was the enantiomeric excess for this reaction? In the boxes, list the percent of each compound in the product mixture. Show all work.



enantiomeric excess (ee)?

6. Draw each of the following showing the correct stereochemistry at each chirality center.

a. (*R*)-2-methylpentane

b. (2*R*, 3*S*)-2,3-dibromobutane

c. meso form of 3,5-heptanediol (diol = 2 OH groups)

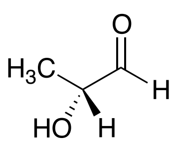
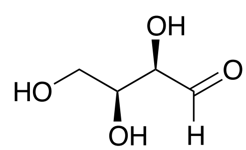
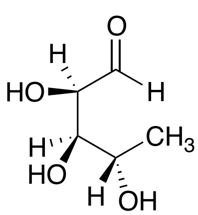
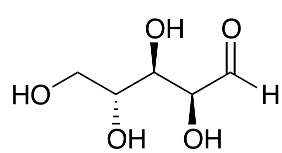
d. most stable chair of (1*R*, 2*R*)-1-isopropyl-2-methylcyclohexane

7. Which of the following solutions would you expect to be optically active? Circle all that apply.

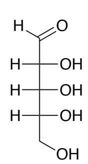
10 g 2-chloro-2-bromopropane dissolved in 100 mL H_2O	10 g (R)-carvone and 10 g (S)-carvone dissolved in 500 mL of CH_2Cl_2	5 g of (2R,3S)-2-bromo-3-chloropentane 5 g of (2R,3R)-2-bromo-3-chloropentane dissolved in an unknown volume of organic solvent
15 g of (R,S)-2,3-dibromobutane dissolved in 25 mL of diethyl ether	Solution formed by adding 5.0 mL of 1-methylbutane to 10 mL of CH_3OH	Solution formed by mixing 8.0 mL of 2.0 M (+)-2-butanol and 4.0 mL of 4.0 M (–)-2-butanol
10 g of racemic *cis*-1-methyl-2-ethylcyclohexane dissolved in octane	10 g of sucrose dissolved in 10 mL of water and placed into a sample cell 10 dm in length	0.01 g of sucrose dissolved in 10 mL of water and placed into a sample cell 10 dm in length

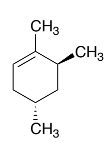
8. Sucrose has a specific optical rotation of 66.5°. If a solution of sucrose is found to have an optical rotation of +23° when measured in a sample cell 15 cm long, what is the concentration of the solution in g/mL? Show all work.

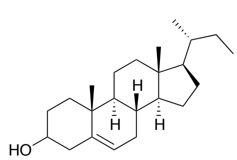
9. Draw Fisher projections for each of the following molecules that places the aldehyde functional group at the top.

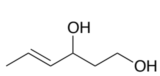
			
			

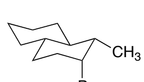
10. Determine how many possible stereoisomers there are for each compound.

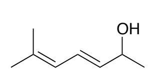












11. Describe the difference between enantiomers and diastereomers in terms of configuration, properties as well as optical rotation.

12. Cholesterol, when isolated from natural sources, is obtained as a single enantiomer. The observed rotation α of a 0.3-g sample of cholesterol in 15 mL of chloroform solution contained in a 10-cm polarimeter tube is –0.78°. Calculate the specific optical rotation of cholesterol.

13. A sample of synthetic cholesterol was prepared consisting entirely of (+)-cholesterol. This synthetic (+)-cholesterol was mixed with some natural (–)-cholesterol. The mixture had a specific rotation of –13°. What was the percentage of (+)-cholesterol? (Note: You will need to use the answer in the question above.)

14. What are the percentages of enantiomers in solution if the enantiomeric excess is 54.8? Show all work.

15. A new chemical reaction produced a mixture of two enantiomers. When 10.0 g of this mixture was dissolved in 50.0 mL of CH_2Cl_2 in a sample cell 20 cm long, the optical rotation was found to be +18.0°. The known specific optical rotation of one of the enantiomers is –74.0. What was the percentage of the (+) and (–) enantiomers produced by the reaction?

16. Circle pairs that are diastereomers

(2R,3R)-2-methyl-3-propyldecane
(2S,3S)-2-methyl-3-propyldecane