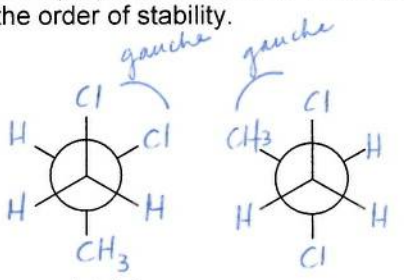
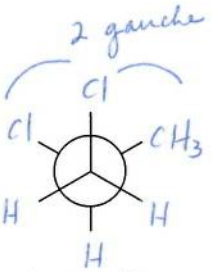
CH_3 is bigger than Cl

1. (10 pts) (a) Draw a Newman projection for each staggered conformation of the C_1-C_2 bond of 1,2-dichloropropane, in order of most stable to least stable from left to right. (b) Briefly explain how you arrived at the order of stability.



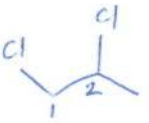
most stable

minimal stencs, the two biggest groups on C_1 & C_2 are opposite (Cl & CH_3) anti



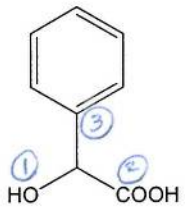
least stable

most steric repulsion among big groups (Cl, Cl, CH_3)

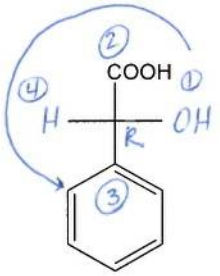


Also: if 1st two structures were swapped, counted correct

2. (4 pts) Mandelic acid can be purchased as the (R)-(-) enantiomer. Complete the Fischer projection for this enantiomer of mandelic acid.

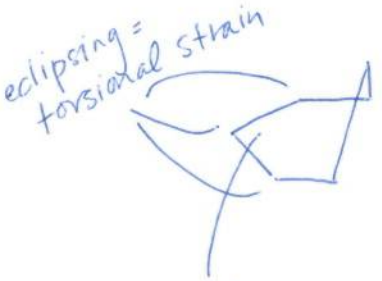


mandelic acid



look S but H is in front

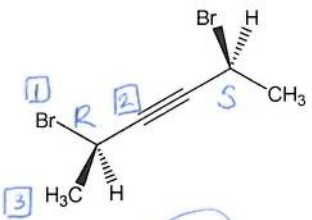
3. (6 pts) Draw a 3D representation of the half-chair conformation, of cyclohexane and clearly annotate the origin of its instability.



eclipsing = torsional strain

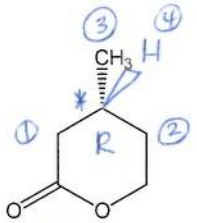
angle strain (120° vs ideal of 109.5°)

4. (15 pts) Which of the following molecules are chiral? Assign each chirality center in the structures below as R or S.

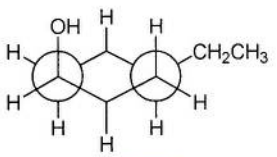


a. chiral / achiral

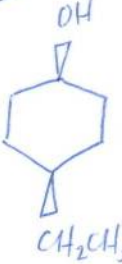
meso



b. chiral / achiral

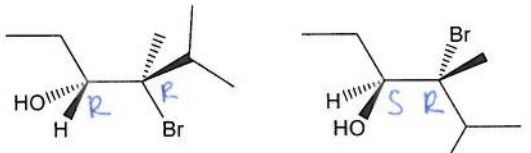


c. chiral / achiral



5. (7 pts each) Indicate whether each of the following pairs of compounds are non-isomeric, constitutional isomers, identical (but not conformers), conformers, enantiomers, or diastereomers. Then decide whether a 50:50 mixture of each pair would rotate plane polarized light and briefly explain why or why not.

a.



diastereomers

Likely to rotate plane-polarized light? yes

Reason for your yes/no choice.

both molecules are chiral; but not enantiomers so won't cancel

b.

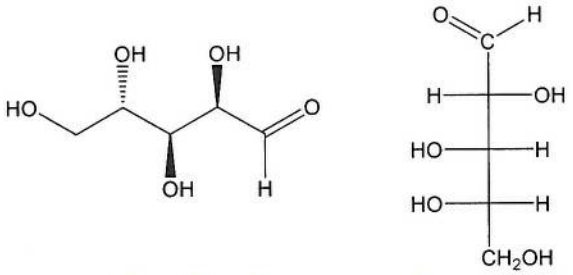
enantiomers

Likely to rotate plane-polarized light? no

Reason for your yes/no choice.

it would be a racemic mixture.

c.



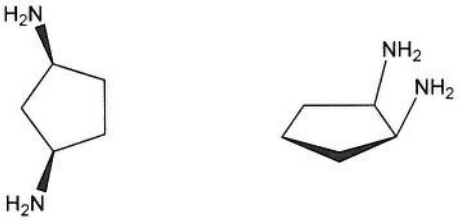
identical → conformers

Likely to rotate plane-polarized light? yes

Reason for your yes/no choice.

it is a chiral molecule

d.



constitutional isomers

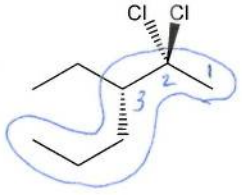
Likely to rotate plane-polarized light? No

Reason for your yes/no choice.

both achiral / meso so optically inactive

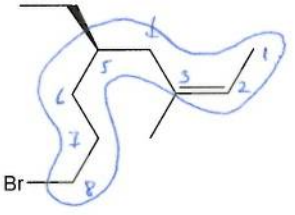
6. (10 pts) Write the full IUPAC name for each of the following molecules.

A



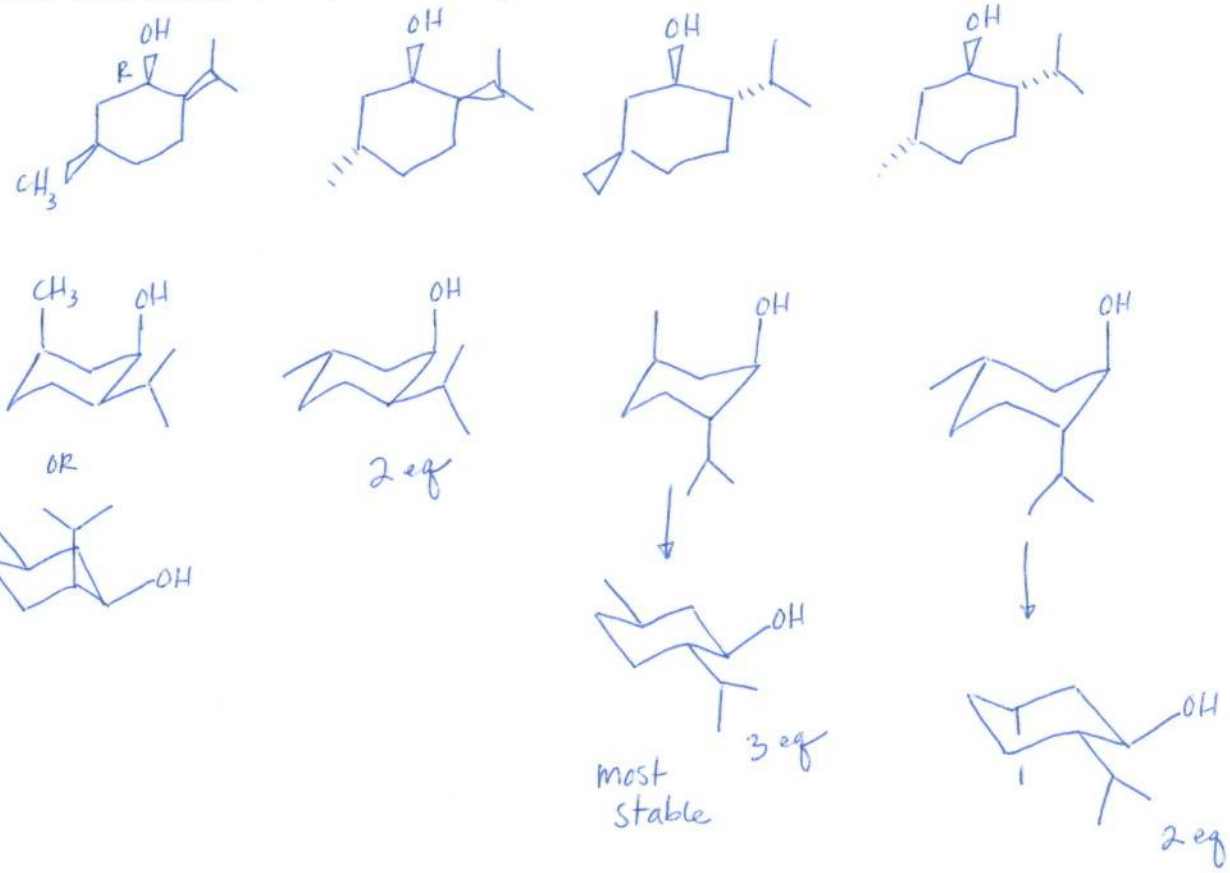
(S)-2,2-dichloro-3-ethylhexane

B



(7,R)-8-bromo-5-ethyl-3-methyl-2-octene

7. (18 pts) There are four possible cis,trans isomers of 2-isopropyl-5-methylcyclohexanol in which the C_1 of the cyclohexane ring has R stereochemistry. (a) Using a **planar hexagon** representation of the cyclohexane ring, draw the structures of the four isomers. (b) Draw the more stable chair conformation for each of your answers in part a. (c) Of the four cis,trans isomers, which is the most stable.



8. (9 pts) Draw cyclopropane and cyclopropene. Predict whether cyclopropane or cyclopropene has the greater (more exothermic) heat of combustion. Clearly explain what is giving rise to the difference in their heats of combustion.

OR

(3) △ has more angle strain (60° vs 120 for sp^2)

⇓

argues for △ being less stable so greater heat of comb.

possible considerations:

(1) a double bond is more stable than a single so it requires more E to break

(2) less H's in cyclopropene are eclipsed so less torsional strain

⇓

both argue for △ having a greater heat of combustion.