

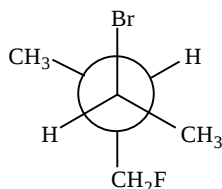
1. There are two major types of diastereomers. Describe these two types and give an example of each.

(1 pt each answer and explanation)

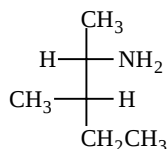
- a. *Cis-trans isomers Example: cis- and trans-2-butene*
- b. *Isomers of compounds with 2 or more chirality centers that are not mirror images of each other, Example: (2R,3R)-dibromopentane and (2R, 3S)-dibromopentane.*

2. Name each compound represented below, including stereolabels.

a.

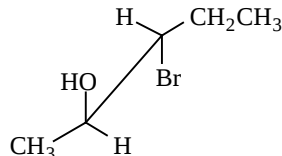


(2R,3R)-3-bromo-1-fluoro-2-methylbutane (6 pts)
(can leave out the numbers in the stereolabels since they're the same label)



b.

(2S,3S)-3-methylpentan-2-amine OR (2S,3S)-3-methyl-2-pentanamine (6 pts)
(can leave out the numbers in the stereolabels since they're the same label)



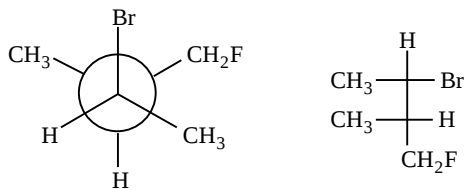
c.

(2S, 3R)-3-bromopentan-2-ol OR (2S, 3R)-3-bromo-2-pentanol (6 pts)

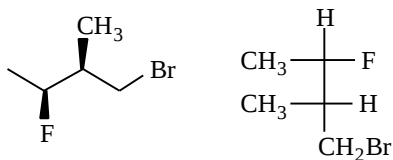
3. A certain product is described as optically inactive, but resolvable. What does this mean? What does it tell you about the product?

It means that the mixture could be separated into two, equal amounts of each enantiomer. It's a racemate (a 50-50 mixture of the enantiomers) so it doesn't rotate the plane of plane-polarized light. (-1 pt if didn't talk about the resolution—separating the enantiomers)

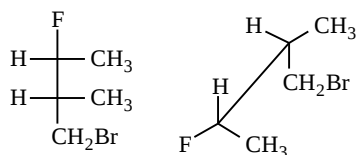
4. What is the relationship between the compounds in each pair below?
(Identical, Enantiomers, Diastereomers, Constitutional isomers)



a. Identical



b. Diastereomers



c. Enantiomers

5. Give the names (with stereolabels as needed) of the products of each mixture below:

- a. 3,3-dimethylbut-1-ene + 0.10 M H_2SO_4 (aq)

2,3-dimethylbutan-2-ol OR 2,3-dimethyl-2-butanol

- b. 3,3-dimethylbut-1-ene + HBr / ROOR

1-bromo-3,3-dimethylbutane

- c. 3,3-dimethylbut-1-ene + (1) BH_3 , (2) H_2O_2 , H_2O , OH^-

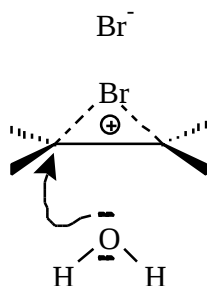
3,3-dimethylbutan-1-ol OR 3,3-dimethyl-1-butanol

6. Draw the most stable form of (1R, 2R)-1, 2-dimethylcyclohexane



7. While treatment of an alkene with bromine in an ether solvent yields a dibromoalkane, the same reaction in aqueous solution gives a completely different product. What is that product and why does it form instead of the dibromoalkane?

The product is a bromohydrin ($R\text{-CHOH-CHBr-R'}$). It forms because the bromonium ion intermediate rapidly reacts with water before the bromide ion produced in the first step can move around to the other side. The side of initial reaction is "guarded" by the Br of the bromonium ion intermediate. (2 pts for bromohydrin, 3 for explanation)



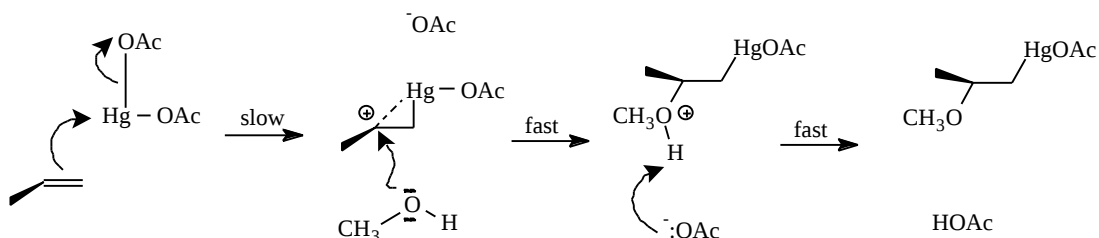
8. A compound has chirality centers yet it is optically inactive. How can this be explained?

It's a meso compound—has an internal mirror plane in which the chirality centers mirror each other.

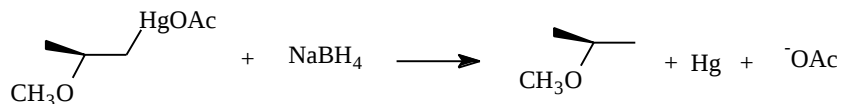
9. Why don't racemic mixtures rotate the plane of plane-polarized light?

Because for every encounter with an enantiomer that rotates the plane one way there's another encounter with its mirror that rotates it back.

10. Write the detailed mechanism for the reaction of propene with mercury(II) acetate and methanol in tetrahydrofuran solvent.

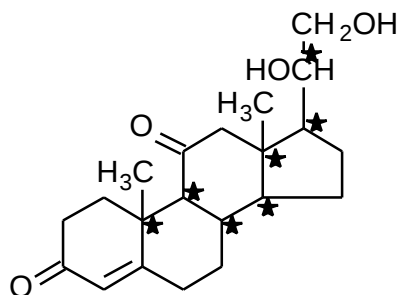


11. How is the product in question 10 converted to a mercury-free product? Show the reaction (not the mechanism).



12. There are three ways to convert an alkene to an alcohol. List the three ways, giving each route's name, reagents, and special characteristics (like regioselectivity, etc.).
- a) **Acid-catalyzed addition of water:** H^+/H_2O , Markovnikov, accompanied by rearrangements if possible (1,2-shifts to form a more stable carbocation intermediate)
 - b) **Oxymercuration-Demercuration:** (1) $HgOAc_2/THF$ (2) $NaBH_4$, Markovnikov, no rearrangements.
 - c) **Hydroboration-Oxidation:** (1) BH_3 (2) H_2O_2, H_2O, OH^- , Anti-Markovnikov, no rearrangements.
13. When cyclopentene is reduced with deuterium gas (Deuterium is 2H , usually written as D, so deuterium gas is D_2) over palladium, the product is 1,2-dideuterocyclopentane. What is the stereolabel that needs to be added to this name? Why is only this product formed in the reaction?
- The stereolabel would be either *cis* or *meso*. The addition of the two D's will occur simultaneously to one face (or the other) of cyclopentene, giving the *cis* geometry. A *cis*-1,2-dideuterocyclopentane is also *meso*.
14. Show (steps, reagents) how to convert 1-cyclobutylethene (also called 1-cyclobutylethylene) to 1-cyclobutylethanol.
- (1) $HgOAc_2, H_2O$ in THF, (2) $NaBH_4$ (You want Markovnikov w/o rearrangement)
15. How many chirality centers are there in the following compound? Put a star by each one.

Seven (7)



4-Pregnene-20,21-diol-3,11-dione, Reichstein's substance T