Final Lab Report **Names**_____
Due Date_____ _____

Exp. 9: *Stereochemistry: Enantiomers and Diastereomers*

EXPERIMENTAL RESULTS
(Complete in pencil or pen!)

Part 1: Definitions

For the following questions, MATCH each definition to a term from the list below. Place the letter of the term in the blank to the left of the definition.

a. enantiomers	e. meso compounds
b. chiral center	f. optically active
c. chirality	g. prochirality center
d. diastereomers	h. achiral

1. _____ describes organic molecules which rotate plane-polarized light.
2. _____ is the property of "handedness"; the property of an object that causes it to be non-superimposable on its mirror image.
3. _____ are stereoisomers that are not mirror images.
4. _____ is an atom in a molecule that is bonded to four different atoms or groups of atoms.
5. _____ are molecules which contain chirality centers and a plane of symmetry.
6. _____describes an sp^3-hybridized atom that can become a chirality center by changing one of its attached groups.

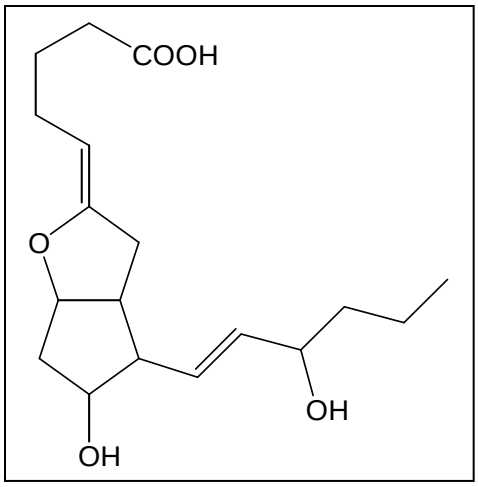
Part 2: Locating Chirality Centers

Skill Builder

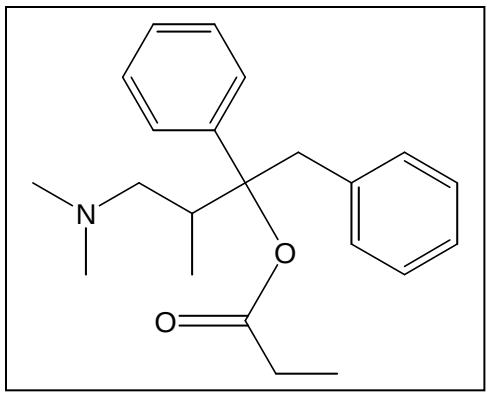
- Ignore sp^2 and sp hybridized centers.
- Ignore CH_2 and CH_3 groups.
- Identify any carbon atoms bearing 4 different groups.

1. Identify the chirality centers in each of the following compounds. Mark each chirality center with a asterisk (*):

a. **Prostacyclin**

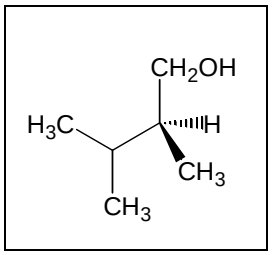


b. **Propoxyphene**

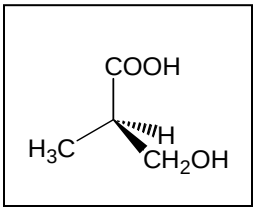


Part 3: Assigning Priorities to Substituents

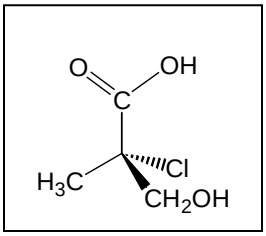
1. Which of the substituents from the list below is the ***lowest*** ranking substituent according to the R, S rules? Circle the correct answer.
   a. $–CH_3$
   b. $–CH_2CH_3$
   c. $–CH(CH_3)_2$
   d. $–C=CH_2$
2. In the compound shown below, circle the substituent with the ***highest*** ranking according to the R, S rules.



3. In the compound shown below, circle the substituent with the ***highest*** ranking according to the R, S rules.



4. In the compound shown below, circle the substituent with the ***highest*** ranking according to the R, S rules.



Part 4: Calculating Specific Rotation

Skill Builder

- Use the following equation: ***specific rotation*** = , where α = observed rotation in degrees, c = sample concentration in g/mL, and = cell pathlength in decimeters
- Plug in given values and calculate for [α].

1. When 0.300g of sucrose is dissolved in 10.0 mL of water and placed in a sample cell 10.0 cm in length, the observed rotation is $+1.99^{o}$. Calculate the specific rotation of sucrose.

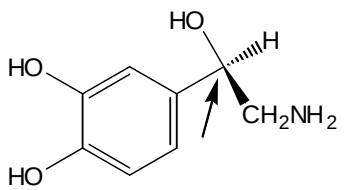
2. Estriol, a potent estrogenic hormone, has been isolated from the urine of pregnant women. When 40 mg of Estriol is dissolved in 1.0 mL of dioxane and placed in a sample tube with a 1.0 dm path length, a rotation of +2.32^{o} is observed. Calculate the specific rotation for Estriol.

Part 5: Assigning R/S Configuration

Skill Builder

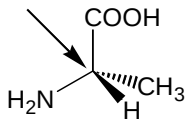
- Identify the four atoms attached to the chirality center and prioritize them by atomic number.
- If two (or more) atoms are identical, make a list of substituents, and look for the first point of difference.
- Redraw the chirality center showing only the priorities (1-4).
- Cover the lowest priority atom. Ignore it for now.
- Identify the direction of 1-2-3 sequence. If clockwise, it is R configuration. If counterclockwise, it is S configuration.
- Now acknowledge the lowest priority atom. As long as it is facing away from you, the configuration is assigned. If it is coming out at you, the configuration must be reversed.

1. Assign R/S configurations to each indicated chirality center in the molecule below. Write the letter R or S by the arrow within the picture.



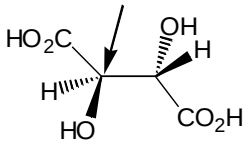
norepinephrine

2. Assign R/S configurations to each indicated chirality center in the molecule below. Write the letter R or S by the arrow within the picture.



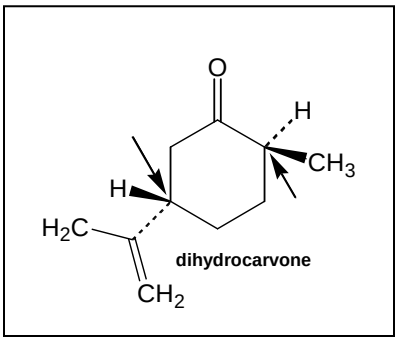
alanine

3. Assign R/S configurations to each indicated chirality center in the molecule below. Write the letter R or S by the arrow within the picture.



tartaric acid

4. Assign R/S configurations to each indicated chirality center in the molecule below. Write the letter R or S by the arrow within the picture.

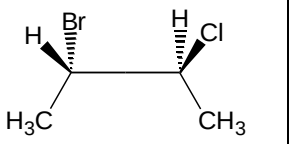


dihydrocarvone

Part 6: Naming with Stereochemistry

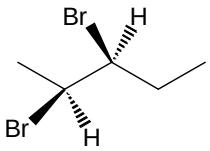
Skill Builder

- When naming compounds containing multiple chirality centers, you must give the configuration around each chiral atom.
- Position number and configuration of each chiral atom in numerical order, separated by commas, all in ( ), at the start of the compound name.
- Absolute configuration, R or S, is italicized.
  - Ex:



(2*S*, 3*S*)-2-bromo-3-chlorobutane

1. Give the IUPAC name, including stereochemistry, of the following compound:



2. In the provided spaces, draw the structures of the compounds using the dash-wedge notation:

a. (1*S*,1*S*)-1-bromo-1-chloroethane	b. (1R,3*S*)-1-chloro-3-methylcyclopentane

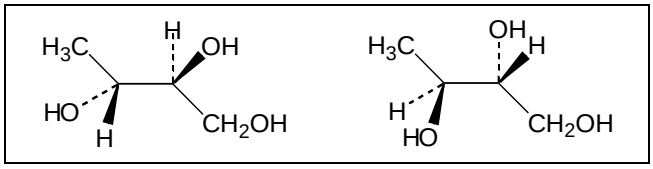
Part 7: Determining the Stereoisomeric Relationship Between Two Compounds

Skill Builder

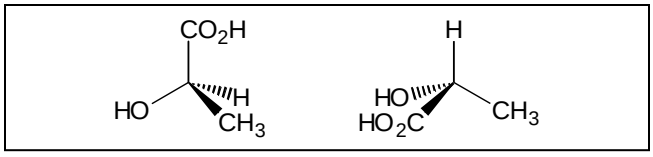
- Compare the configuration of each chirality center.
- If all chirality centers have opposite configuration, the compounds are enantiomers.
- If only some of the chirality centers have opposite configurations, then the compounds are diastereomers.
- If all chirality centers are the same, the compounds are identical.

1. Identify the stereoisomeric relationship between each pair of stereoisomers. Using the letter (E) for enantiomers, the letter (D) for diastereomers, and the letter (I) for identical, place the correct letter in the provided blank to the left of the pair of stereoisomers.

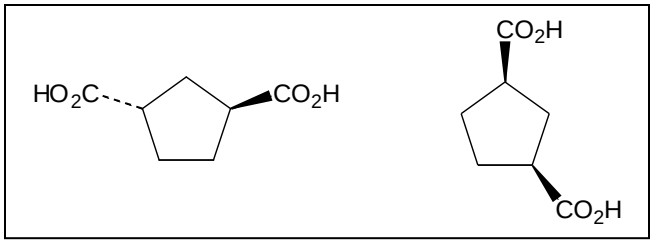
a. _____



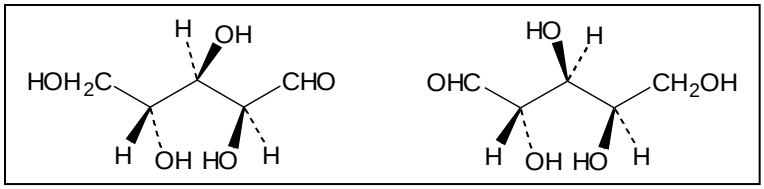
b. _____



c. _____



d. _____



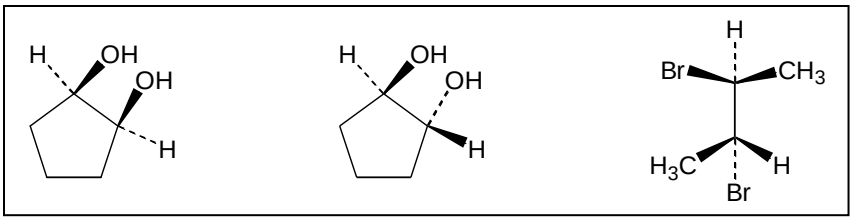
e. _____

Part 8: Identifying Meso Compounds

Skill Builder

- Draw all possible stereoisomers of a compound.
- Look for a plane of symmetry anywhere in any of the drawings. The presence of a plane of symmetry indicates a meso compound.

1. Circle the structures which represent meso compounds. Indicate the plane of symmetry with a dashed line if applicable.



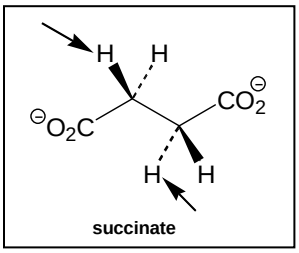
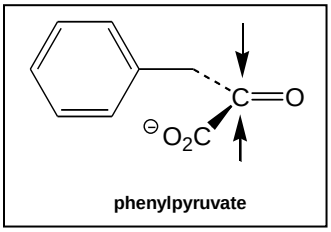
2. Which of the following is a meso compound?
   a. (2*R*, 3*S*)-dibromobutane
   b. (2*R*, 3*R*)-dibromobutane
   c. (2*R*, 3*R*)-3-bromo-2-butanol
   d. (2*R*, 3*S*)-3-bromo-2-butanol

Part 9: Prochirality

Skill Builder

- Draw the plane that includes the sp^2 carbon and its substituents, and rank the substituents.
- For the upper face, draw the arrow that proceeds from group 1-2-3. If the direction is clockwise, the face is the *Re* face. If the rotation is counterclockwise, the face is the *Si* face.

1. Identify the indicated hydrogens in the following molecule as *pro-R* or *pro-S*.



2. Identify the indicated faces in the following molecule as *re* or *si*.