

# What is Stereochemistry and Chirality?

## Worksheet

A chiral molecule has a central atom (usually carbon) bonded to four different groups. Its mirror image (enantiomer) is a different compound with different properties, even though the atoms are identical.

## Questions

- How many different spatial arrangements are possible for a molecule with 2 chiral centers?  
A) 2  
B) 4  
C) 3  
D) 8
- Which molecule is chiral?  
A) CH (methane)  
B) CCl<sub>2</sub>H (dichloromethane)  
C) CHCl (chloroform)  
D) CHClBr (bromomethyl iodide)
- What is the relationship between two enantiomers?  
A) They are the same compound  
B) They are mirror images (non-superimposable)  
C) They have different molecular formulas  
D) They don't exist together
- Glycine (simplest amino acid) is NOT chiral because  
A) it has no central C  
B) two of its groups on the central C are identical (both H)  
C) it is too small  
D) all amino acids are achiral
- Is glyceraldehyde (CHO with one chiral center) chiral?
- Can propane (CH<sub>3</sub>) have chiral forms?
- Why do amino acids (except glycine) exist as L and D forms?
- Define: What makes a carbon chiral?
- Define: What is an enantiomer?
- Define: What is the difference between D- and L- forms?

## Answer Key

1. B) 4 - With 2 chiral centers, each can be R or S independently  $2 \times 2 = 4$  stereoisomers.
2. D)  $\text{CHClBrI}$  (bromomethyl iodide) -  $\text{CHClBrI}$  has 4 different groups (H, Cl, Br, I) on one C chiral. Others have repeated groups.
3. B) They are mirror images (non-superimposable) - Enantiomers are optical isomers-mirror images that cannot be overlaid no matter how you rotate them.
4. B) two of its groups on the central C are identical (both H) - Glycine's central C is bonded to: H, H, NH, COOH. Two H atoms are identical achiral (no D/L form).
5. Glyceraldehyde has one central C with 4 different groups: H, OH, CHO, CHOH. Since all 4 are different, it IS chiral exists as D and L enantiomers.
6. Middle carbon of propane: bonded to CH, CH, H, H. Two CH groups are identical NOT chiral no D/L forms.
7. Amino acids have a central C bonded to: H, amino group (NH), carboxyl (COOH), and R side chain. All 4 groups are different (R others) central C is chiral.
8. It must be bonded to 4 different atoms or groups.
9. One of two non-superimposable mirror images of a chiral molecule.
10. D and L refer to the spatial arrangement at the chiral center (Fischer projection convention). They're optical isomers.

### **Bounlu**

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