(21) **Today**

Sections 5.1 – 5.5
Chirality and Determining the Configuration of Chiral Centers

Next Class (22)

Sections 5.1 – 5.5
Chirality and Determining the Configuration of Chiral Centers

Sections 5.6 – 5.12
Diastereomers, N,P, and S, and Prochirality

(23) **Second Class from Today**

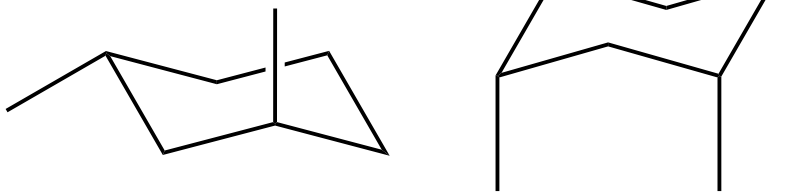
Test 2 on Chap 2, Sections 2.7 through 2.12, Chap 3, and Chap 4.1 through 4.8

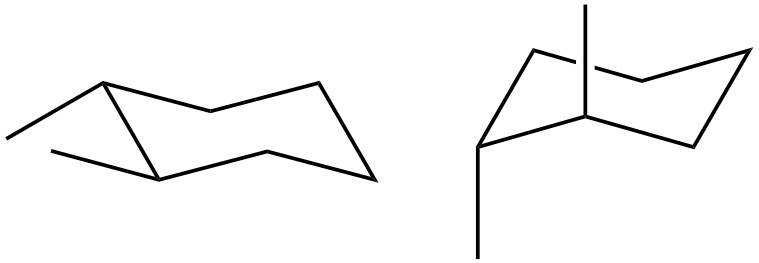
Third Class from Today (24)

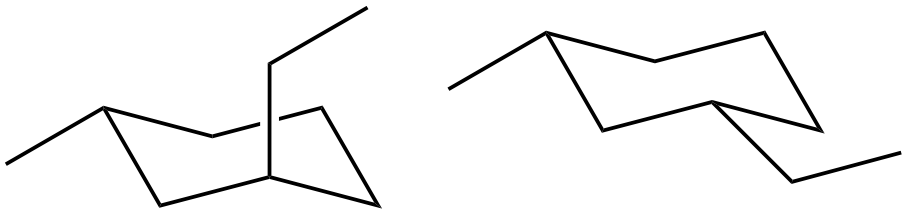
Sections 5.6 – 5.12
Diastereomers, N,P, and S, and Prochirality

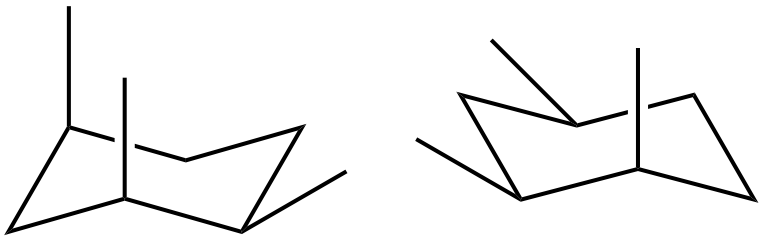
Which of the Following Pairs Represent Ring-flipped Cyclohexanes

Section 4.3 – 4.8

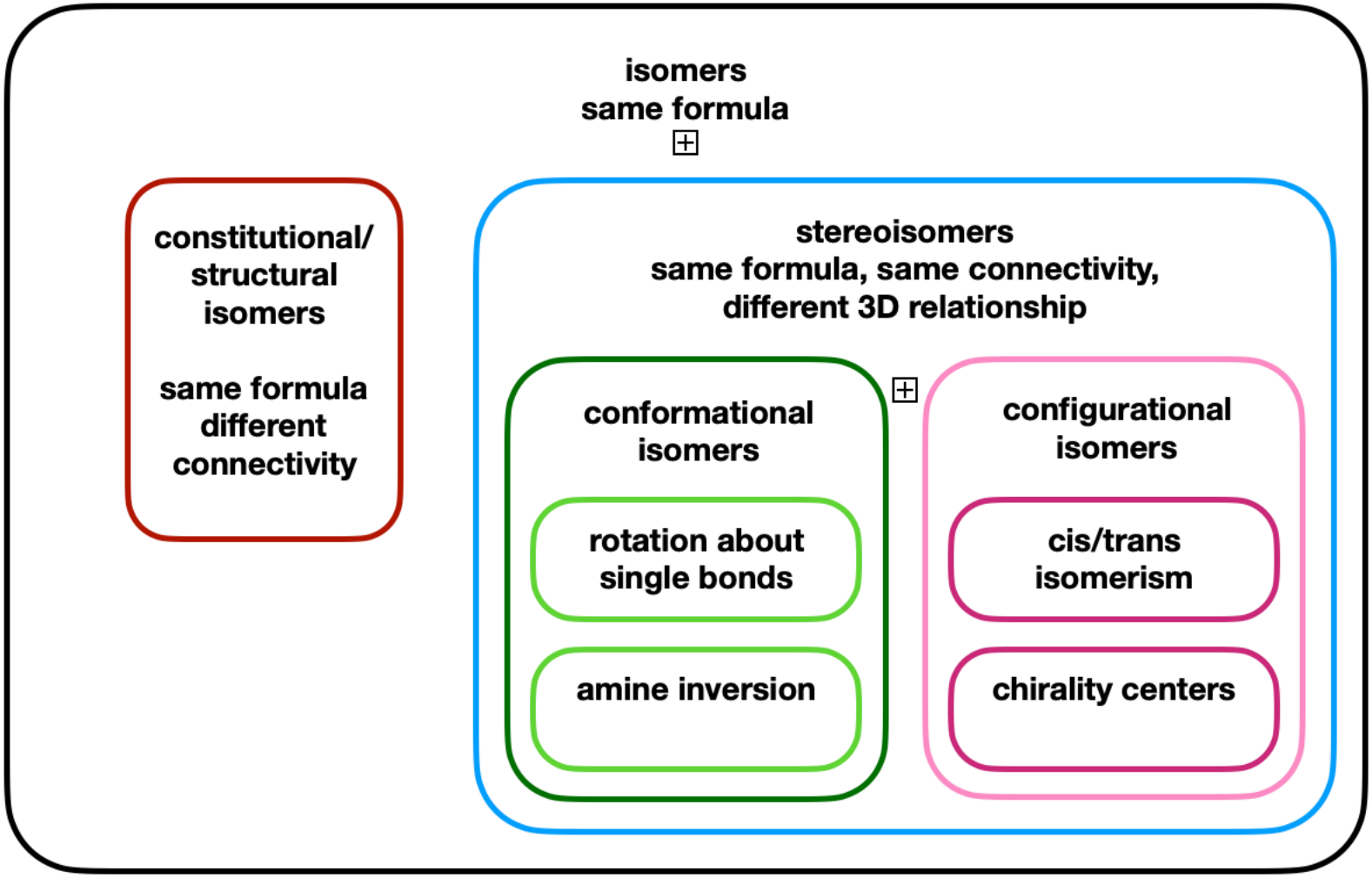


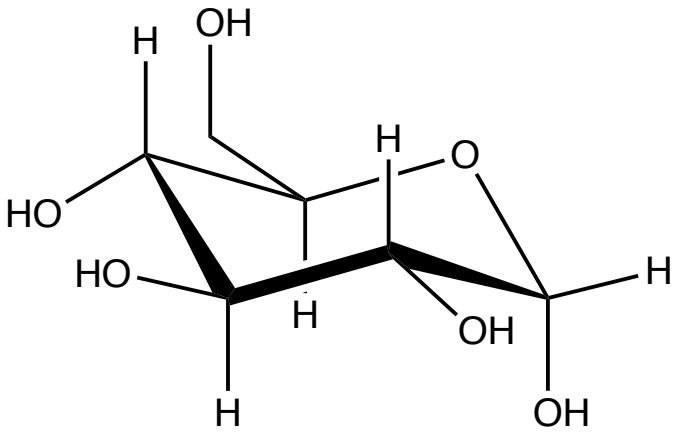




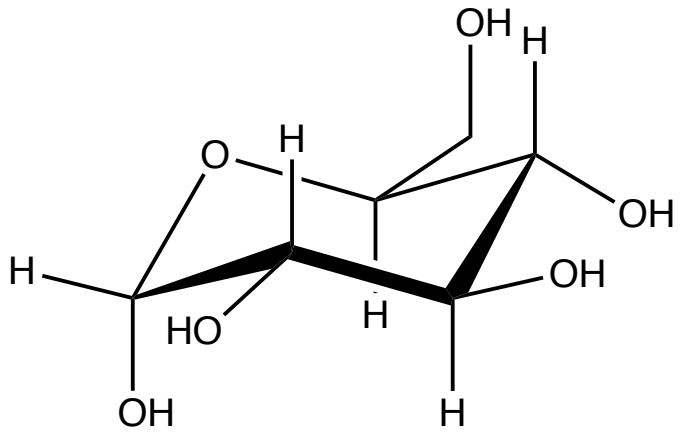


Handedness is a form of stereoisomerism: same connections different 3-D relationships.



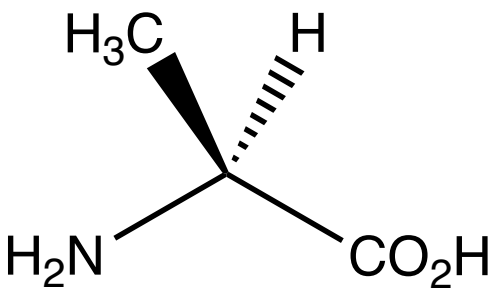


D-glucose
11¢ per gram

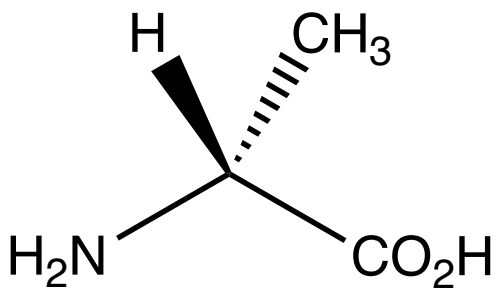


L-glucose
$130 per gram

Fisher Scientific, 2024



L-alanine



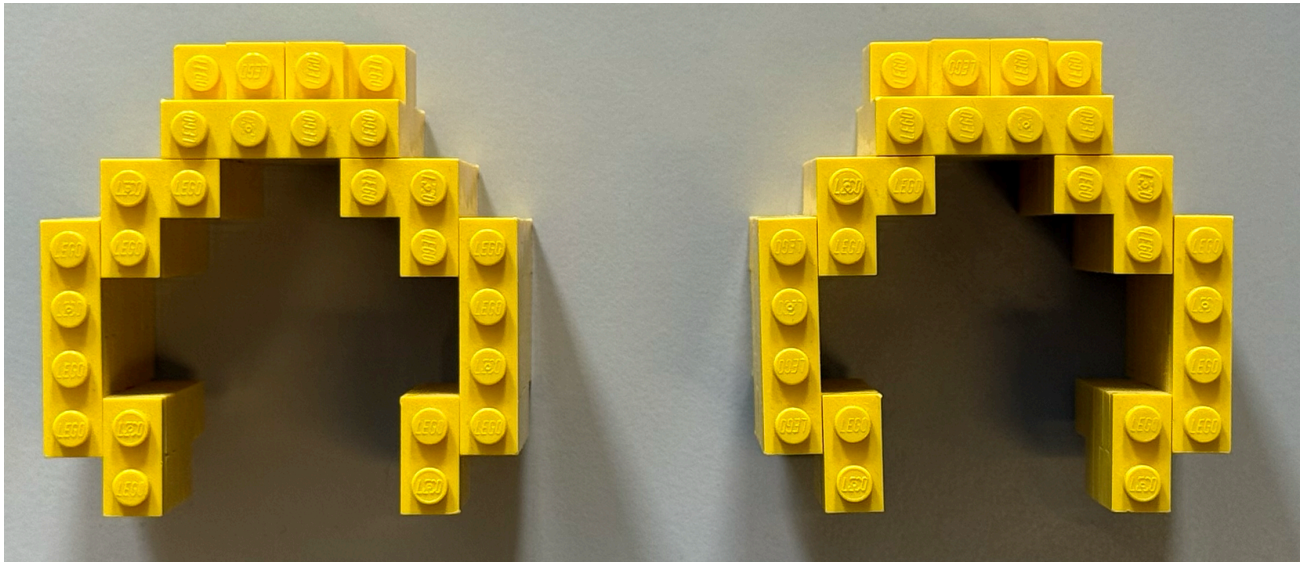
D-alanine

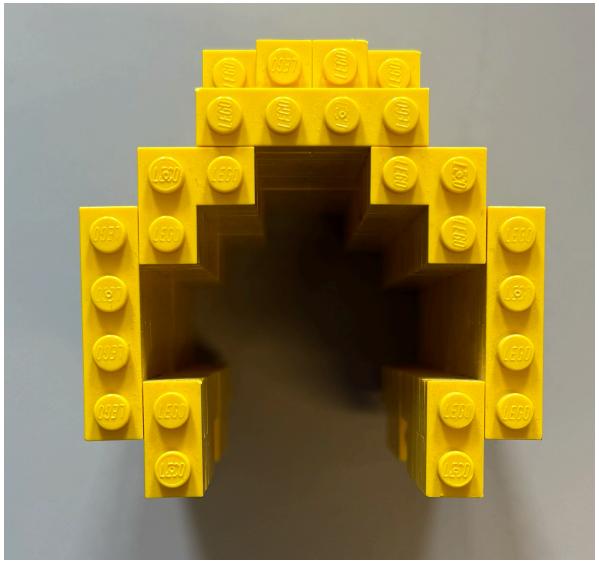
our proteins are made from this one

Handedness: What makes your hands or your feet have handedness?

Does the large LEGO minifigure have a right hand?

Handedness: What makes your hands or your feet have handedness?





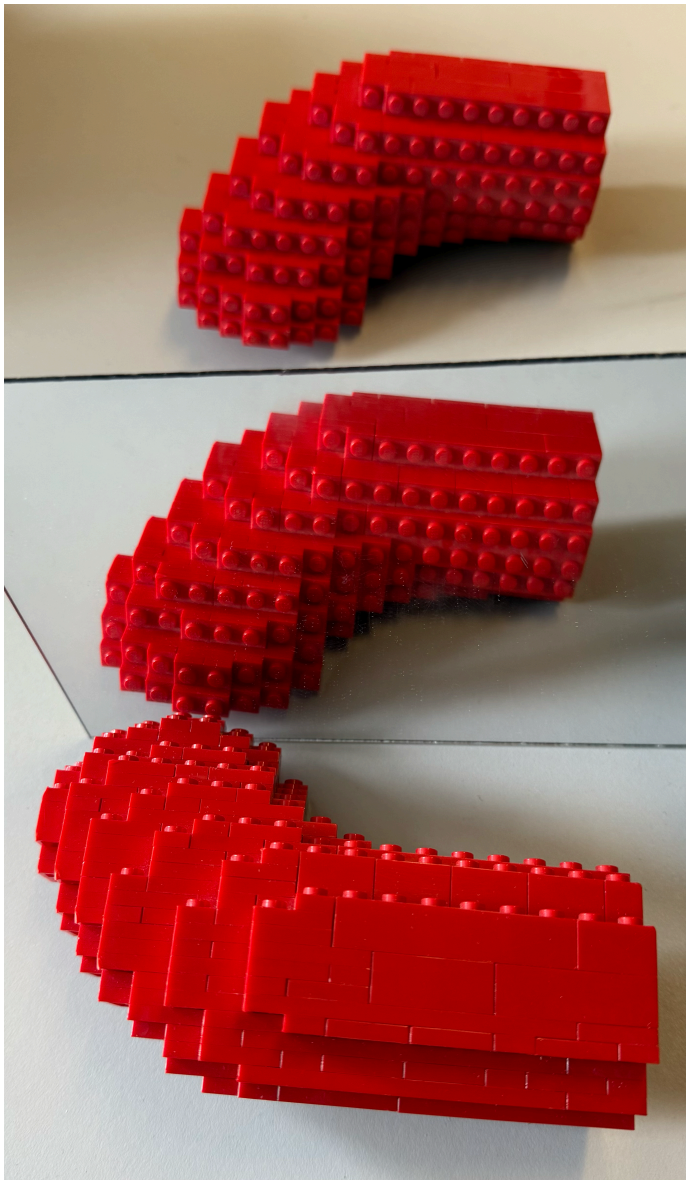
Does the large LEGO minifigure have a right hand?

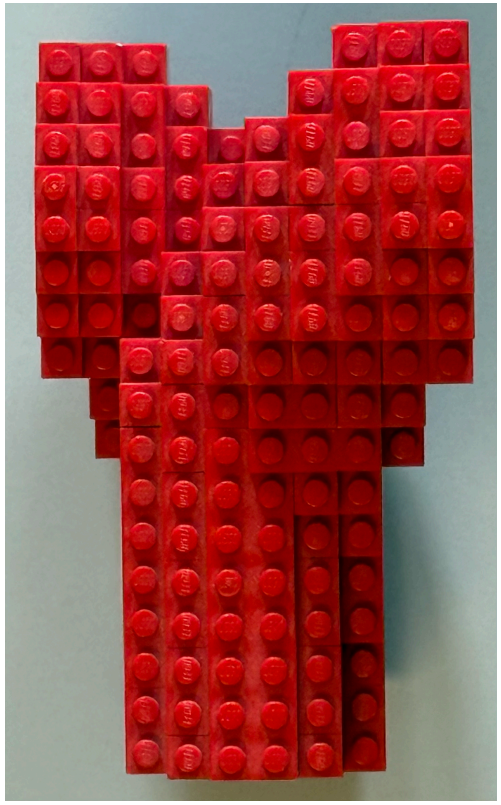
No, they’re just hands… neither is a left or a right hand.
They just happen to be on the left and right sides of the minifigure.

Handedness: What makes your hands or your feet have handedness?

Try again… Does the large LEGO minifigure have a right arm?

Handedness: What makes your hands or your feet have handedness?



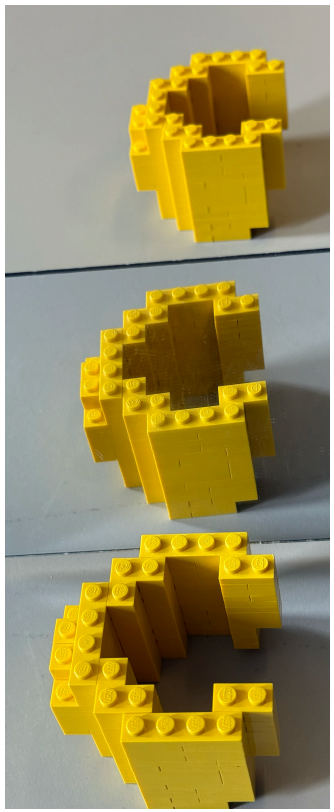


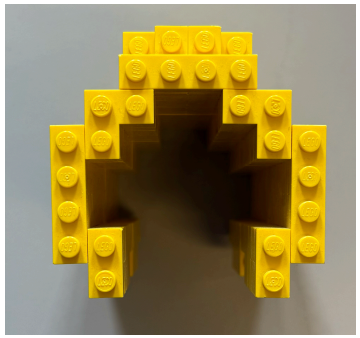
Try again… Does the large LEGO minifigure have a right arm?

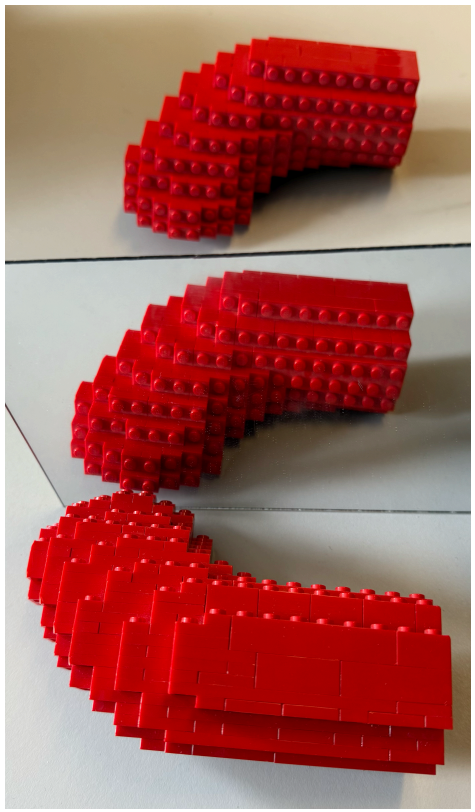
YES, the minifigure's arms have handedness.

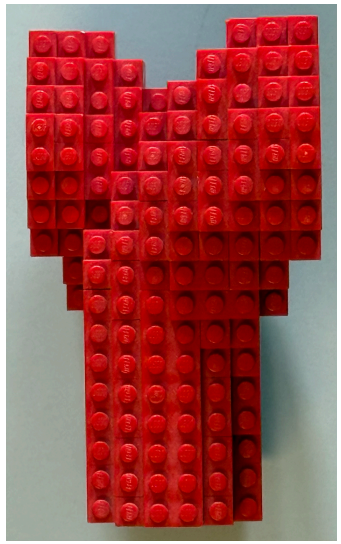
Handedness: What makes **your** hands or feet have handedness? Section 5.1 – 5.5

The mirror image of your left hand is not superposable onto your left hand.







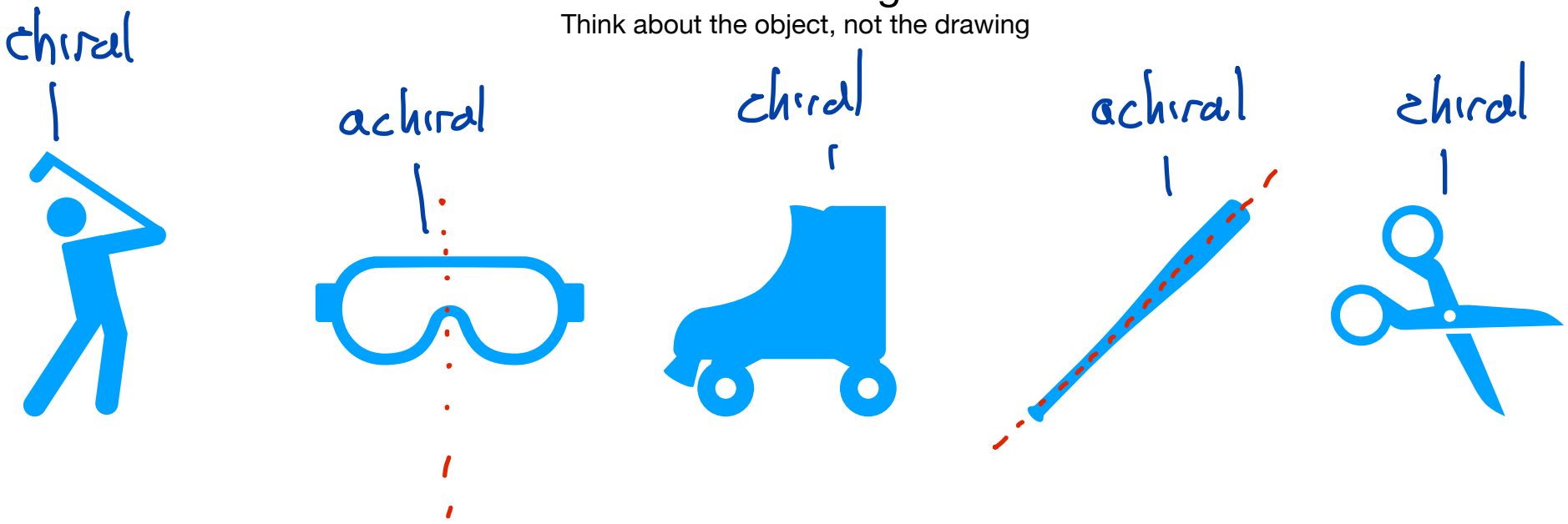


Superposable means that when you superimpose the two objects everything lines up.

The mirror image of a chiral object is not superposable on the original object

Which of the following are chiral?

Think about the object, not the drawing



these objects contain a mirror plane

(cut them in half + regenerate the missing half using a mirror)

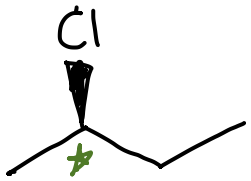
chiral objects lack a plane of symmetry (a mirror plane)

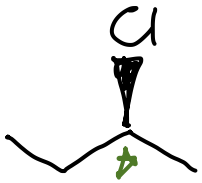
Build

2-chlorobutane

Cl , CH_2CH_3 ,

CH_3 , H

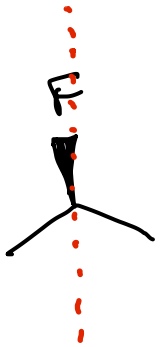


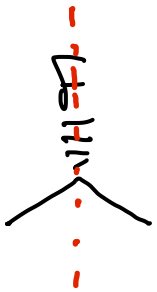


chiral molecules

not the same

2-fluoropropane



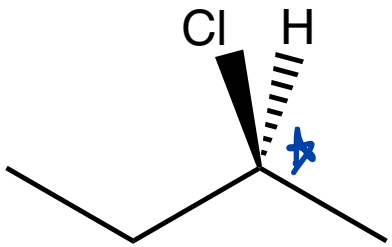


achiral

same

The mirror image of a Chiral Object is not superposable on the original object

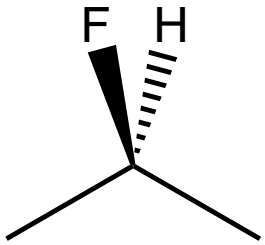
A chiral object cannot have an internal mirror plane (a.k.a. plane of symmetry)*



Cl
Me (CH_3)
Et (CH_2CH_3)
H

chiral

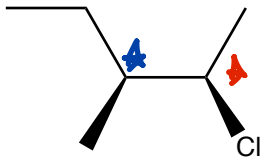
vs

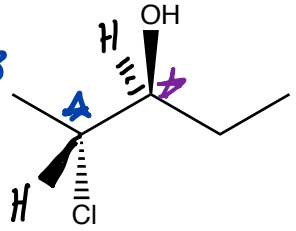


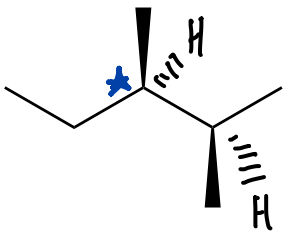
F
Me (CH_2)
Me

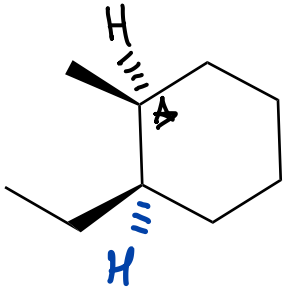
not chiral

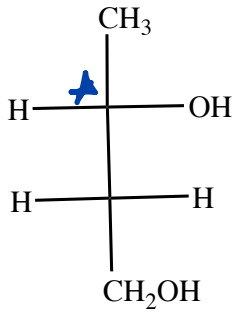
*Technically, it's an improper axis of rotation, but a mirror plane is an S_1 and a center of inversion is an S_0, and almost every point group that contains an S_n axis also contains a mirror plane of some sort. The S_4 point group is only point group that has an improper axis of rotation and doesn't also have a plane of symmetry. The Ci point group is the only point group that has a center of inversion and doesn't also have a plane of symmetry.

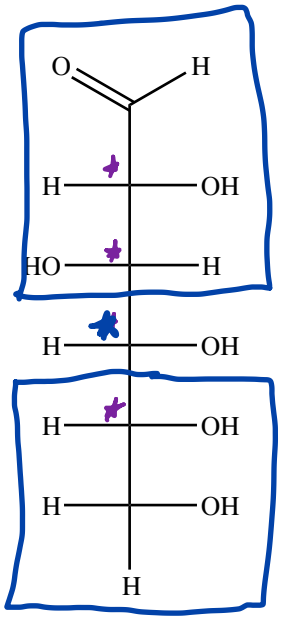

Cl

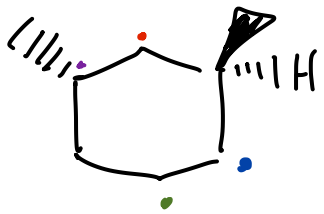

OH
H
H
Cl


H
H


H
H


CH3
H
OH
H
H
CH2OH


O
H
H
OH
HO
H
H
OH
H
OH
H
OH
H

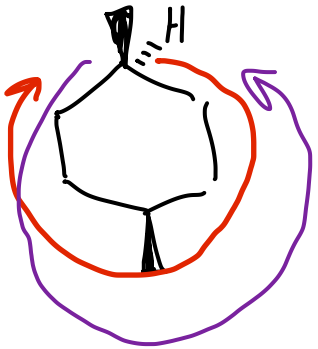


$^{\bullet}CH_2\,^{\bullet}CH(CH_3)$

$^{\bullet}CH_2\,^{\bullet}CH_2$

CH_3

H



H

CH_3

same { $CH_2CH_2CH(CH_3)CH_2CH_2$; $CH_2CH_2CH(CH_3)CH_2CH_2$

Definitions

stereoisomers are molecules that have the same connectivity but different 3-D relationships between parts of the molecules

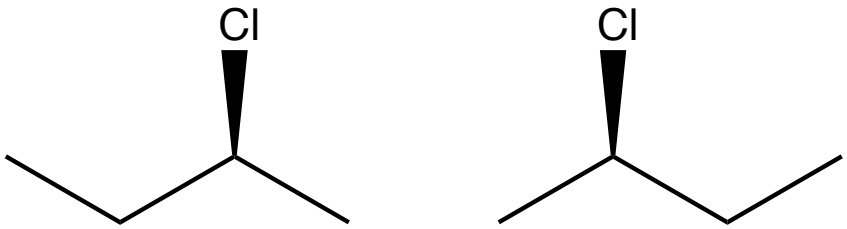
e.g. (*R*)-2-chlorobutane vs (*S*)-2-chlorobutane

right handed | left handed

The word **enantiomer** describes the relationship between two stereoisomers.

enantiomers are stereoisomers that are nonsuperposable mirror images of each other and an object must be chiral to have an enantiomer

e.g. (*S*)-2-chlorobutane vs (*R*)-2-chlorobutane



Definitions

stereoisomers are molecules that have the same connectivity but different 3-D relationships between parts of the molecules

e.g. (*cis*)-1,2-dimethylcyclohexane vs (*trans*)-1,2-dimethylcyclohexane

The word **diastereomer** describes the relationship between two stereoisomers.

Diastereomers are stereoisomers that are nonsuperposable but are **NOT** mirror images of each other