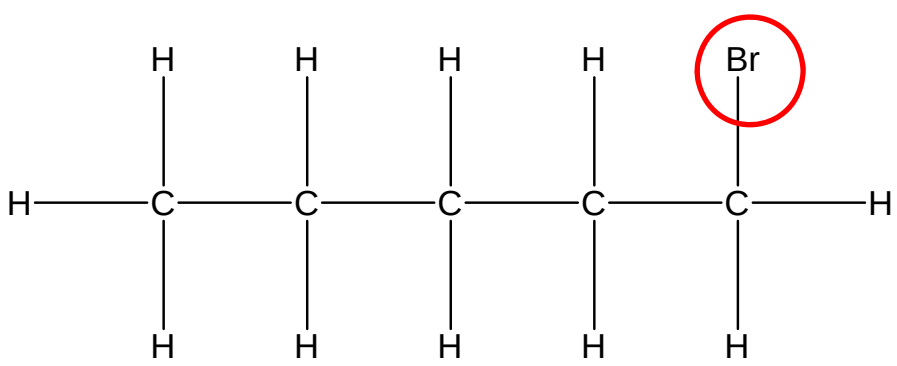
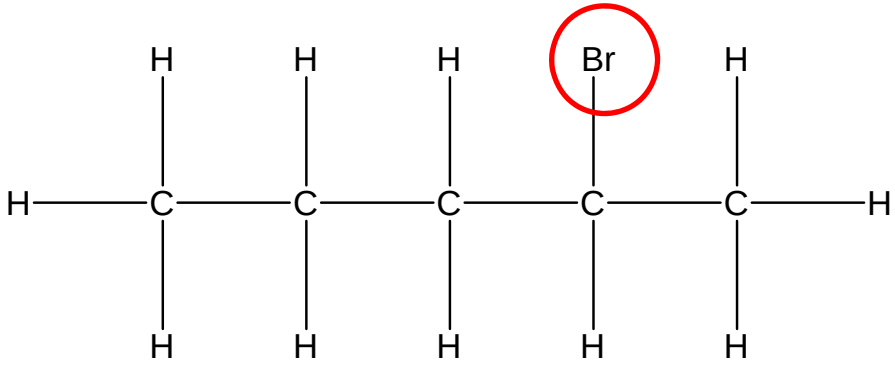
Isomers

What do you know about isomers in organic chemistry?
Brainstorm with your neighbour

Structural (constitutional)





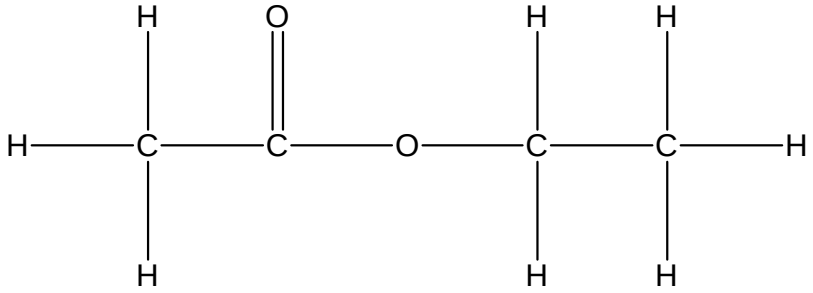
Definition:

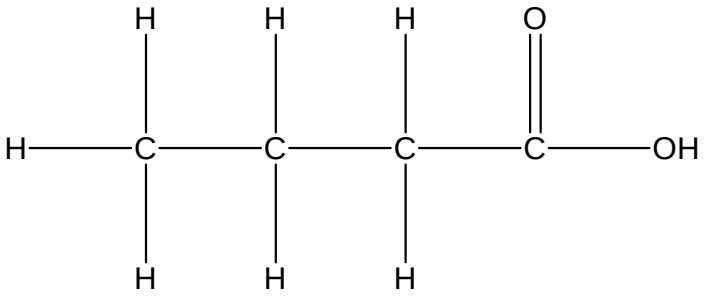
Same molecular formula (number and type of atoms), different bonding arrangement.

Structural isomers

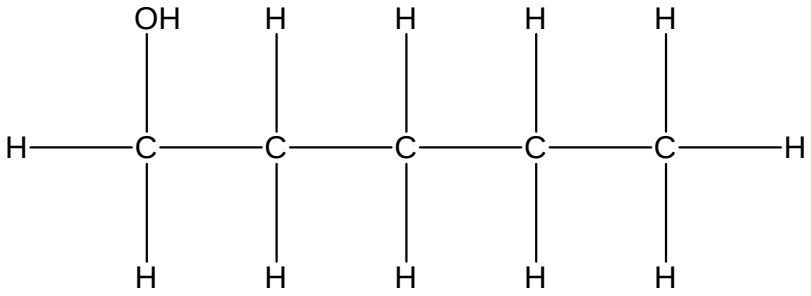
Are the following pairs of compounds structural isomers?

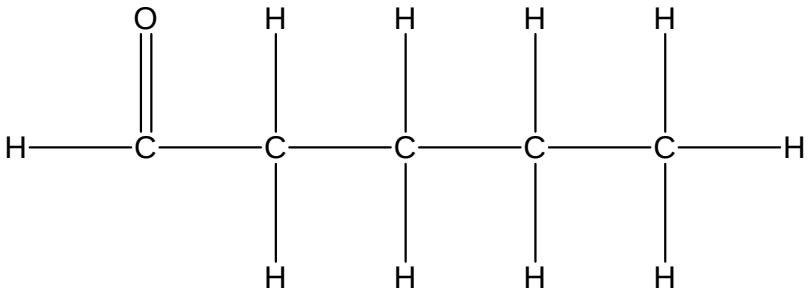
1.



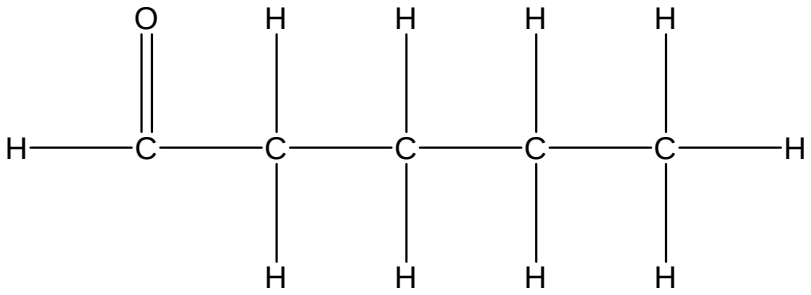


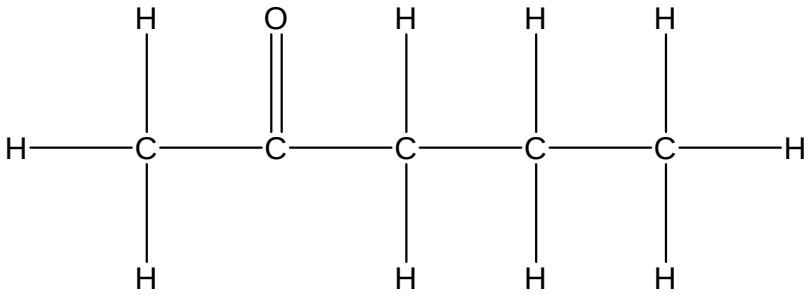
2.



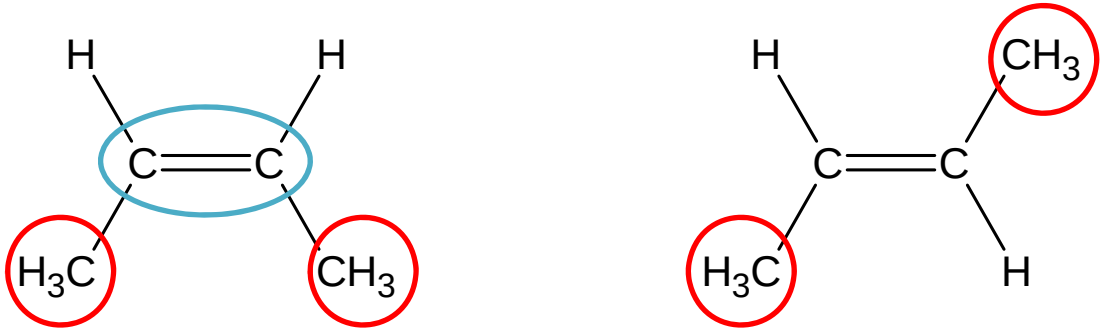


3.





Geometric isomers



cis-but-2-ene

trans-but-2-ene

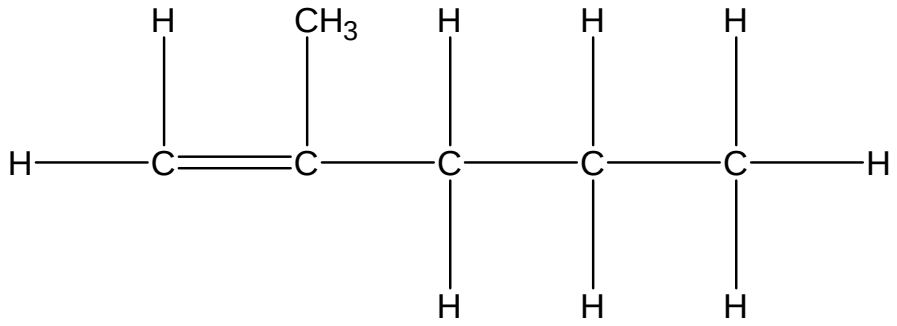
Definition:

Same molecular formula (number and type of atoms), same bonding arrangement, different geometry around a bond that can not rotate.

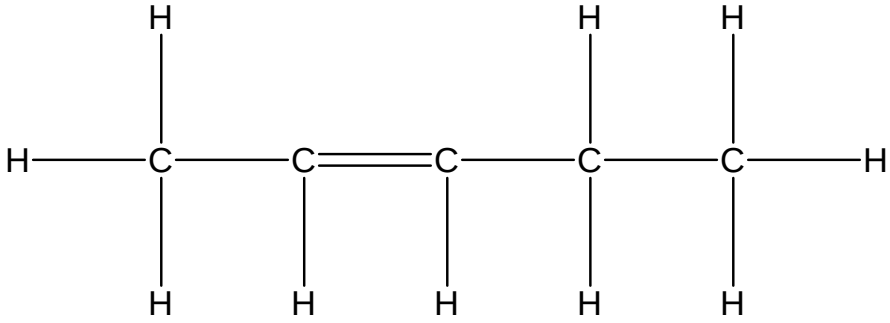
Geometric isomers

Can the following compounds form geometric isomers?

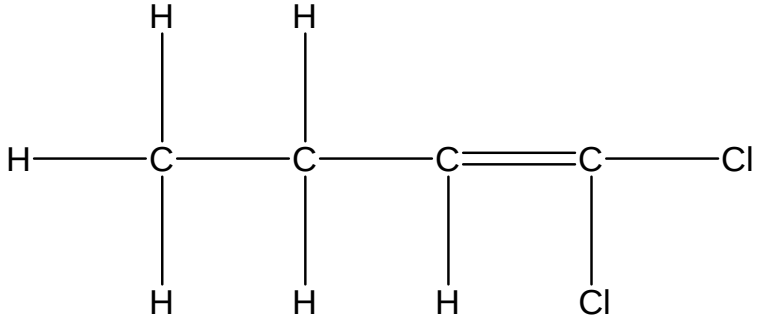
1.



2.

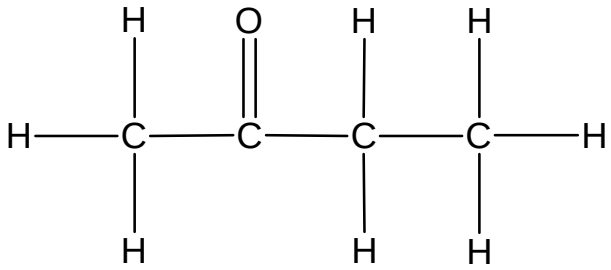


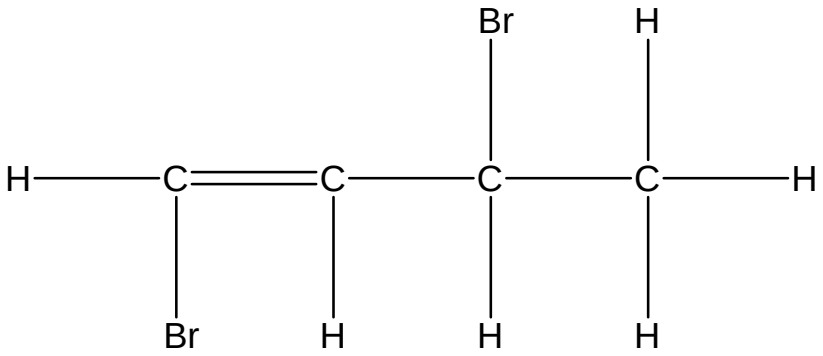
3.

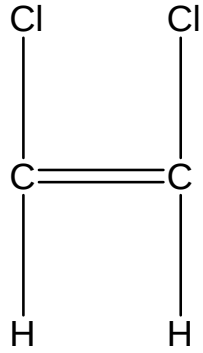


Do now:

Can the following compounds form geometric isomers?



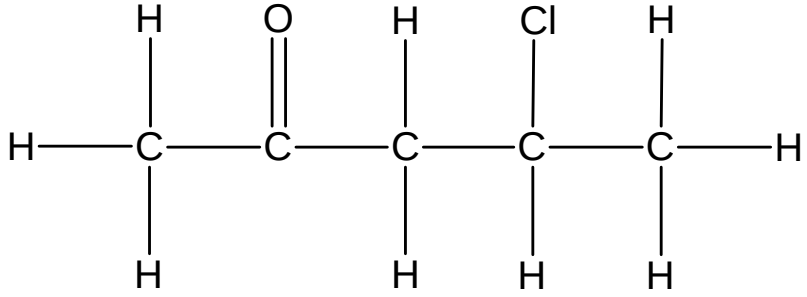


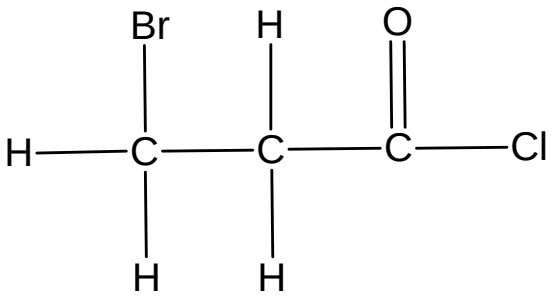


Draw as many structural isomers as you can of 2-hydroxyprop-1-ene (Hint: there are 5 more!)

Do now:

Name the following compounds:





Draw the following compounds:

2-chlorobutanal

3-hydroxypropanamide

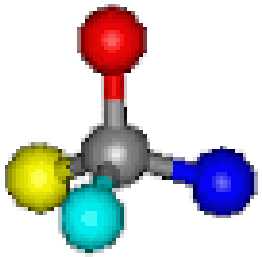
2-ethylbutanoyl chloride

Optical isomers

We learn about one new type of isomer this year – optical isomers. What do you think we can tell about this type of isomerism from the name?

Optical isomers occur when four different atoms or groups are attached to the same carbon atom.

Use your molymods to attach for different atoms to a carbon atom (this carbon atom is called a **chiral** or **asymmetric** carbon)



Molecule

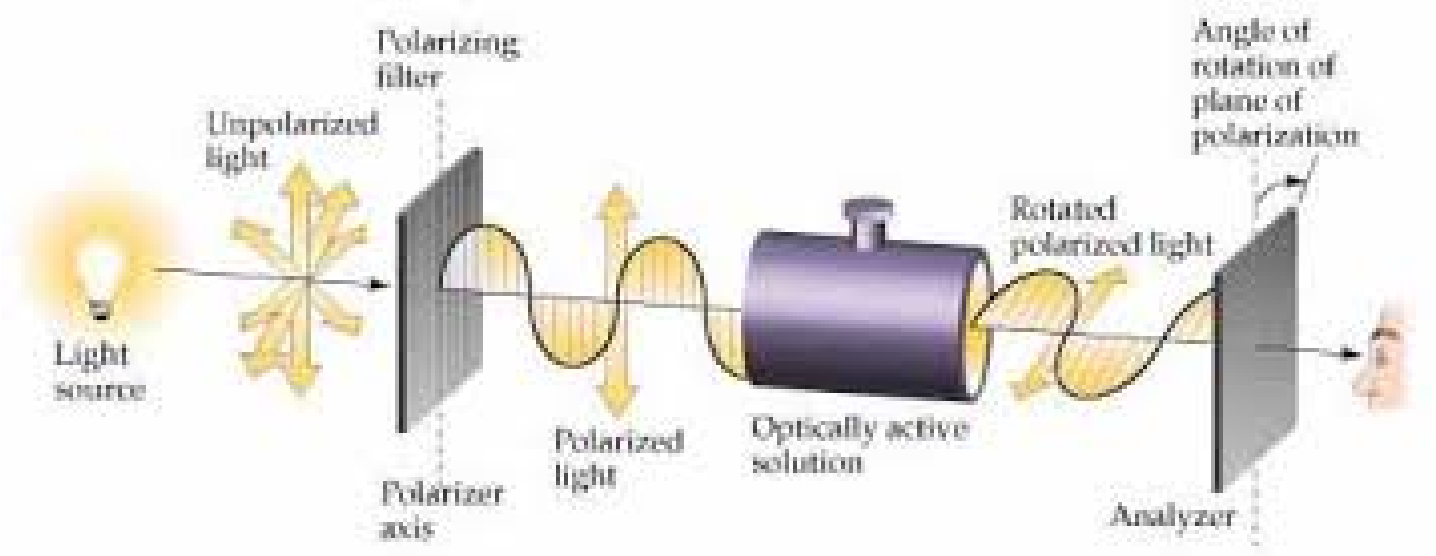
Make a mirror image of this compound

Can you superimpose the compounds on each other?

Optical isomers

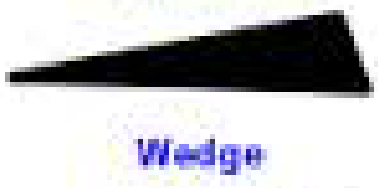
Optical isomers

Optical isomers have the same chemical and physical properties.
The only difference is the way that they rotate plane polarised light.



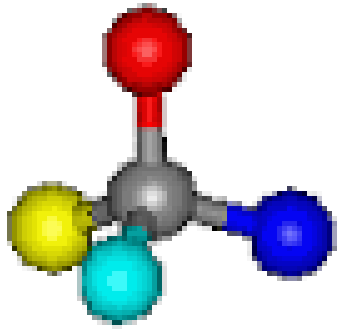
Drawing optical isomers

We use dashed and wedge bonds to represent the 3 dimensional image in 2 dimensions.

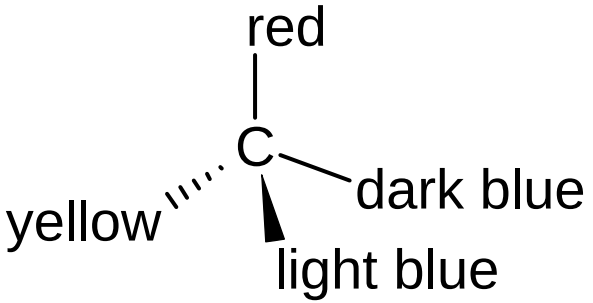


Coming out of page

Going into page

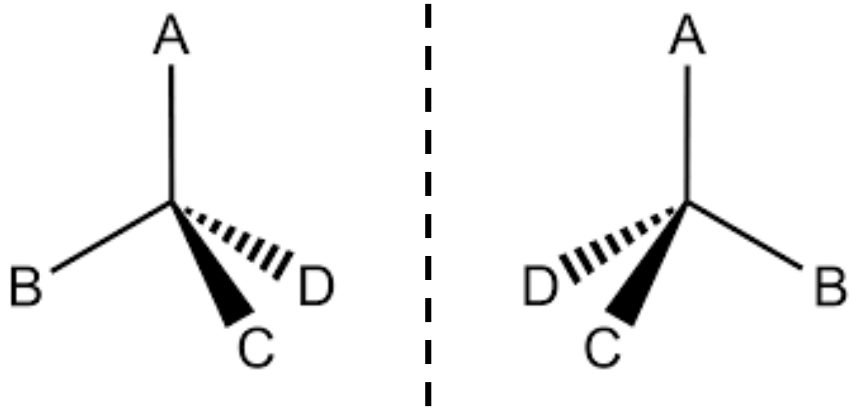


=



Drawing optical isomers

Optical isomers are **non-superimposable** mirror images



Make with your molymods, then draw using dash and wedge bonds the two optical isomers (**enantiomers**) of the following compounds

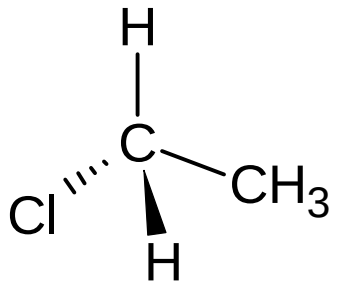
2-chlorobutane

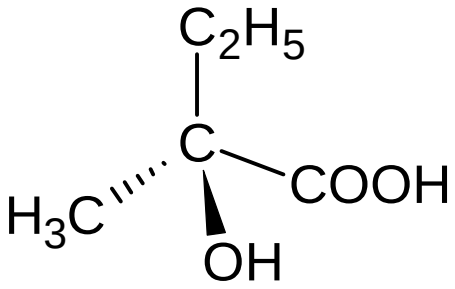
2-bromopropanoic acid

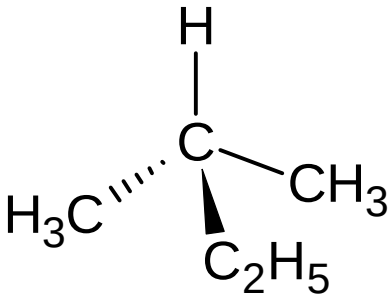
1-bromo-1-chloroethane

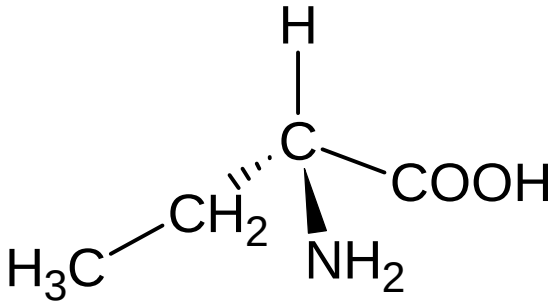
Do now:

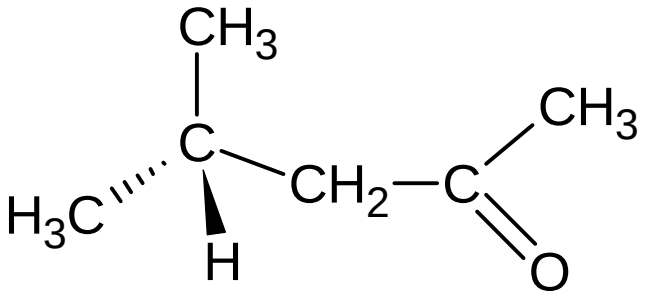
Will the following compounds form optical isomers (**enantiomers**)? If yes circle the carbon that is **chiral**.











Key vocabulary

Chiral

Asymmetric

Non-superimposable

Plane polarised light

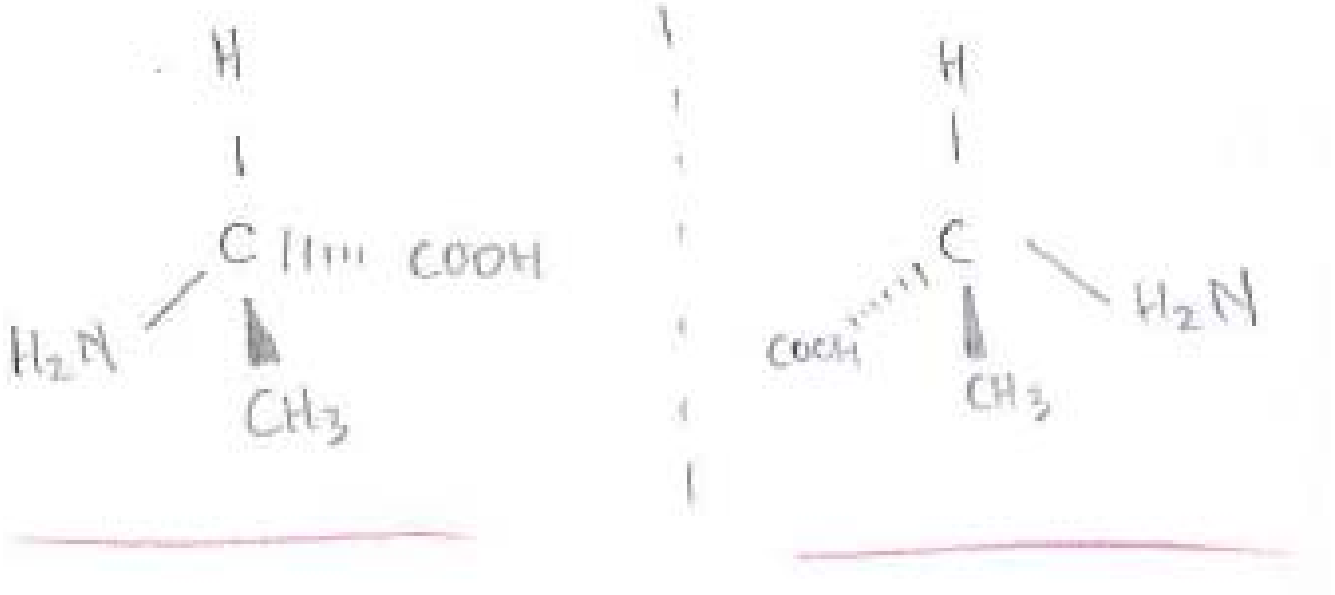
Mirror images

Enantiomers

2013 Sample Exam Q1

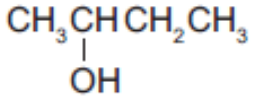
(b) The amino acid alanine below can exist as two enantiomers (optical isomers).

(i) Draw three-dimensional structures for the two enantiomers that clearly show the relationship between them.

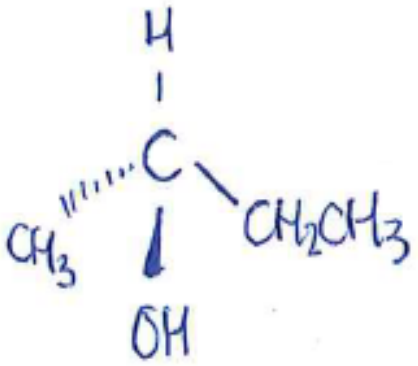


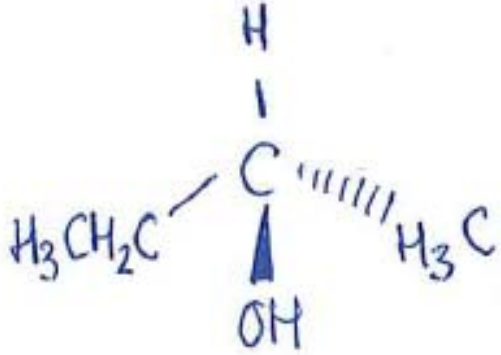
2013 Exam Q1

(b) The alcohol below can exist as two enantiomers (optical isomers).



(i) Draw three-dimensional structures for the two enantiomers.





2013 Exam Q1

(ii) Link the structure of enantiomers to a physical property that can be used to distinguish them from non-optically active molecules.

Enantiomers are organic molecules that contain an assymetric chiral carbon bonded to four different groups. The mirror images are non-superimposable and they can be distinguished as they rotate the plane of polarised light in opposite directions. 2 butanol is an enantiomer as it has a chiral carbon bonded to four different groups: H, CH_3, OH and CH_2CH_3.