

AQA Chemistry A-level

Topic 3.7 - Optical Isomerism

Flashcards



What property must a carbon atom have for the molecule to display optical isomerism about that carbon atom?



What property must a carbon atom have for the molecule to display optical isomerism about that carbon atom?

4 different substituents attached to one carbon atom



What are the similarities and differences between two optical isomers?



What are the similarities and differences between two optical isomers?

Same atoms and bonds, but they are non-superimposable mirror images of one another. **NOT IDENTICAL** in chemical properties necessarily.

Differ in the way they rotate plane polarised light - rotate plane of polarisation by the same angle but in different directions.



What word is used to describe optically active molecules?



What word is used to describe optically active molecules?

chiral



What are the pair of isomers called?



What are the pair of isomers called?

Enantiomers



What is the chiral centre?



What is the chiral centre?

The carbon that has four different substituents attached to it



How is the chiral centre denoted?



How is the chiral centre denoted?

C^* (star on C)



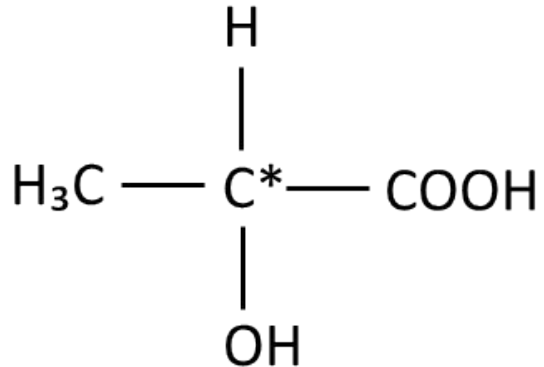
Give two examples of chiral molecules. Draw one of them (both enantiomers).



Give two examples of chiral molecules. Draw one of them (both enantiomers).

All alpha amino acids, except glycine.

Lactic acid / 2-hydroxypropanoic acid



How is light polarised?



How is light polarised?

By passing it through a polaroid filter, so oscillations are only in one plane.



What effect does the racemic mixture have on plane polarised light?



What effect does the racemic mixture have on plane polarised light?

None, as the rotation by each enantiomer cancels out to nothing



What effect does the +
isomer have on plane
polarised light?



What effect does the + isomer have on plane polarised light?

Rotates plane of polarisation by x° clockwise



What effect does the -
isomer have on plane
polarised light?



What effect does the - isomer have on plane polarised light?

Rotates plane of polarisation by x° anti clockwise
(same angle, opposite direction)



What is the structure of a polarimeter?



What is the structure of a polarimeter?

Light source (unpolarised light) → polarising filter (polarised light) → polarised light passes through compartment containing sample → detector determines the angle of rotation of the plane polarised light



What are polarimeters used for?



What are polarimeters used for?

To identify which enantiomer is present, the purity of the sample, the concentration of the sample etc.

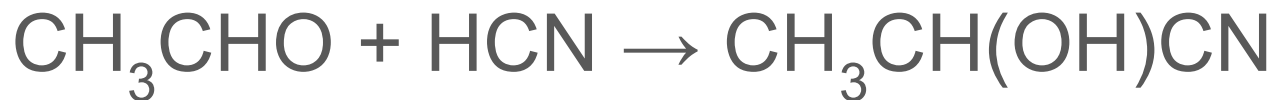


What is the first stage of the synthesis of lactic acid (2-hydroxypropanoic acid) from ethanal? (Equation).



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(Reagents are KCN and HCl but it is acceptable to write HCN in the balanced equation as this is the H^+ from the HCl and ^-CN from KCN)



Why is the $\text{CH}_3\text{CH}(\text{OH})\text{CN}$
molecule formed chiral?



Why is the $\text{CH}_3\text{CH}(\text{OH})\text{CN}$ molecule formed chiral?

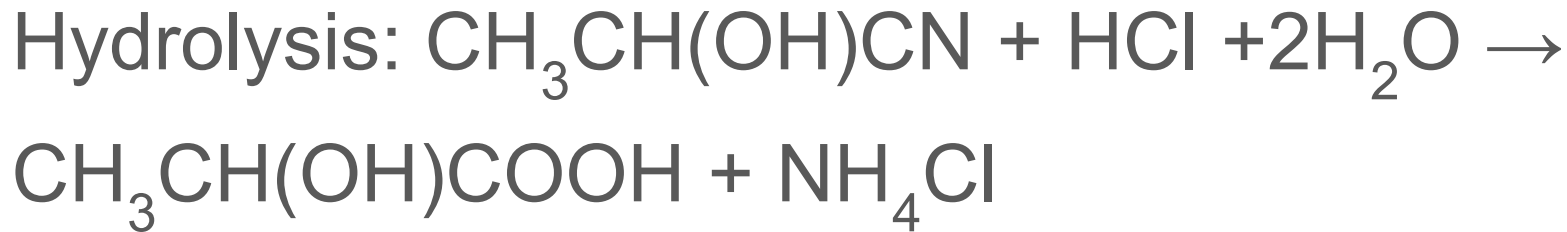
H, CH_3 , OH and CN groups attached to the central chiral carbon atom - 4 substituents



What is the second stage of
the synthesis of lactic acid
(2-hydroxypropanoic acid)
from ethanal?



What is the second stage of the synthesis of lactic acid (2-hydroxypropanoic acid) from ethanal?



How does this second stage affect the chirality?



How does this second stage affect the chirality?

Does not affect it - still racemic as chirality not affected by this stage.



Are racemic mixtures formed in nature? Why?



Are racemic mixtures formed in nature? Why?

Not often, as enzyme mechanisms are 3D so only form one enantiomer



Why is optical isomerism a problem for the drug industry?



Why is optical isomerism a problem for the drug industry?

Sometimes, only one enantiomer is effective due to enzyme's active site/cell receptors being 3D.



What are the options to resolve the issue of only one enantiomer being effective?



What are the options to resolve the issue of only one enantiomer being effective?

1. Separate enantiomers - difficult and expensive as have very similar properties
2. Sell racemate - wasteful as half is inactive
3. Design alternative synthesis to only produce one enantiomer.



Examples of optically active drugs?



Examples of optically active drugs?

Ibuprofen, Thalidomide



Why is ibuprofen able to be sold as a racemate, even though the + isomer is needed to treat inflammation?



Why is ibuprofen able to be sold as a racemate,
even though the + isomer is needed to treat
inflammation?

Sold as 50% racemate.

But body converts 60% of R- isomer to S+ isomer → end up
with 80% S+ isomer

