WJEC (Wales) Chemistry A-level

Topic 4.1 - Stereoisomerism

Flashcards

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What are stereoisomers?

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What are stereoisomers?

Stereoisomers are compounds with the same structural formula, but with a different arrangement of atoms in space.

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How is stereoisomerism different to structural isomerism?

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How is stereoisomerism different to structural isomerism?

Structural isomers have the same molecular formula but different structural formulas. Stereoisomers have the same molecular formula and the same structural formula and only differ in the arrangement of the atoms in space.

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Give the two main types of stereoisomerism

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Give the two main types of stereoisomerism

Optical isomerism

E-Z isomerism

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What is E-Z isomerism?

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What is E-Z isomerism?

E-Z isomerism occurs due to the restricted rotation around a carbon double bond. This means that if both the double-bond carbons have different groups attached to them, then different isomers are produced depending on the arrangement of the groups around the double bond.

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Name and define the two isomers E-Z isomerism produces

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Name and define the two isomers E-Z isomerism produces

E-isomer - the high priority groups on each side of the double bond are diagonally across from each other.

Z-isomer - the high priority groups on each side of the double bond are either both above or both below the carbon double bond.

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Draw and name the two isomers produced from but-2-ene

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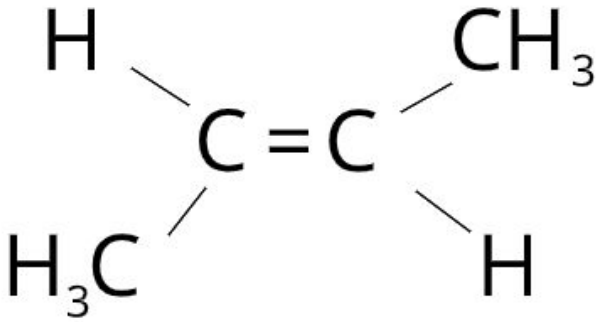
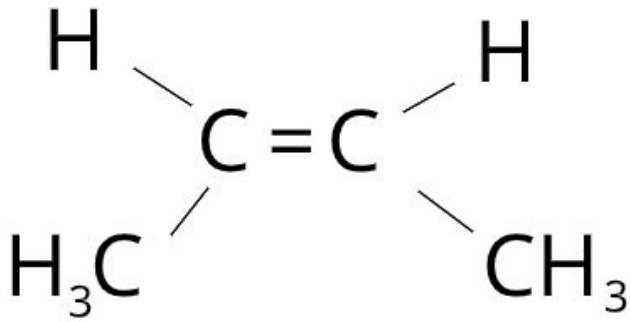
Draw and name the two isomers produced from but-2-ene



E-isomer:
E-but-2-ene



Z-isomer:
Z-but-2-ene

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Draw and name the two isomers produced from 1-bromo-1-chloro-2-methylbutane

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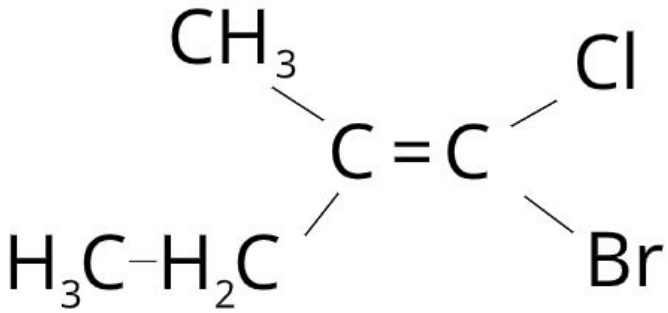
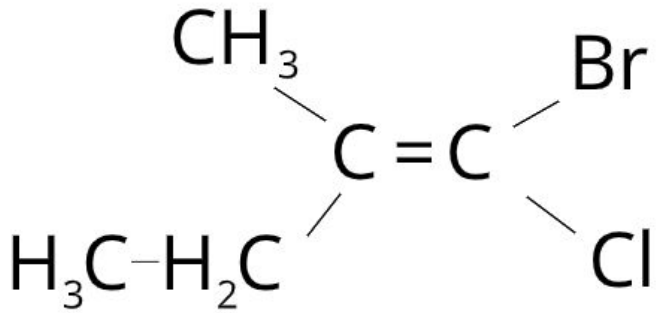
Draw and name the two isomers produced from 1-bromo-1-chloro-2-methylbutane



Z-isomer:
Z-1-bromo-1-chloro-2-methylbutane



E-isomer:
E-1-bromo-1-chloro-2-methylbutane

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How can you determine the priority of the groups in E-Z isomerism?

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How can you determine the priority of the groups in E-Z isomerism?

Look at the atoms which are directly bonded to each of the C=C carbon atoms. On each carbon, the atom with the higher atomic number is given the higher priority.

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Define optical isomerism

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Define optical isomerism

Optical isomerism is a type of stereoisomerism. Optical isomers have the same structure but are non-superimposable mirror images of each other.

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What is a chiral centre?

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What is a chiral centre?

A chiral centre is a carbon atom which has four different groups attached to it. It is often called the chiral or asymmetric carbon.

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Why is a chiral centre required for optical isomerism?

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Why is a chiral centre required for optical isomerism?

A chiral centre has four different groups attached to it and these groups can be arranged in different ways to give two different molecules known as optical isomers.

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How is a chiral centre often denoted?

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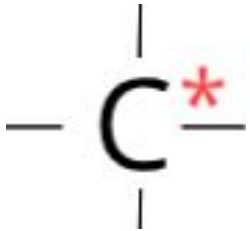
How is a chiral centre often denoted?

The chiral centre is generally indicated by * next to the chiral carbon.



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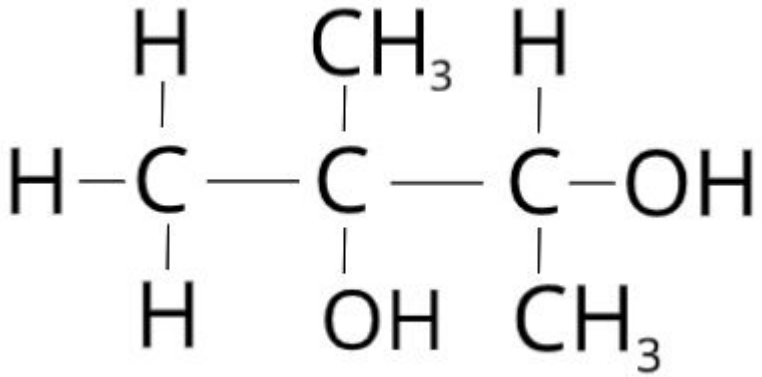
Find the chiral centre of the following molecule



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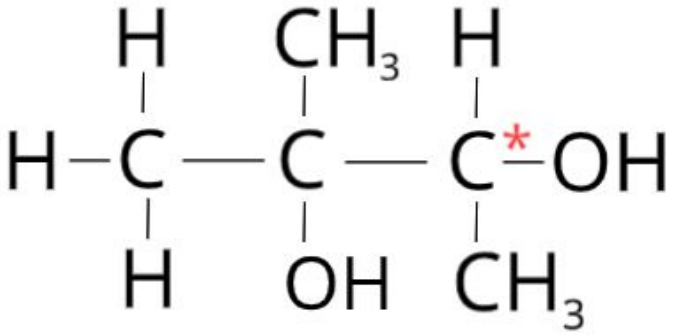
Find the chiral centre of the following molecule

The carbon on the right hand side is the chiral carbon since it has 4 different groups attached to it.



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Define enantiomer

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Define enantiomer

Two different molecules which are non-superimposable mirror images of each other and arise from optical isomerism.

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Explain the optical activity of optical isomers

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Explain the optical activity of optical isomers

Optical isomers are optically active which means they rotate plane polarised light.

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How does the optical activity differ for a pair of enantiomers?

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How does the optical activity differ for a pair of enantiomers?

The two enantiomers will rotate plane polarised light in opposite directions.

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What is a racemic mixture?

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What is a racemic mixture?

A racemic mixture is a mixture which contains equal quantities of each enantiomer of an optically active compound.

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What is another term for a racemic mixture?

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What is another term for a racemic mixture?

A racemate.

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

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

A racemic mixture has no effect on plane polarised light since there are equal quantities of each enantiomer present. Each enantiomer rotates plane polarised light in opposite directions so they cancel each other out.

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Draw the two enantiomers of 2-hydroxypropanoic acid

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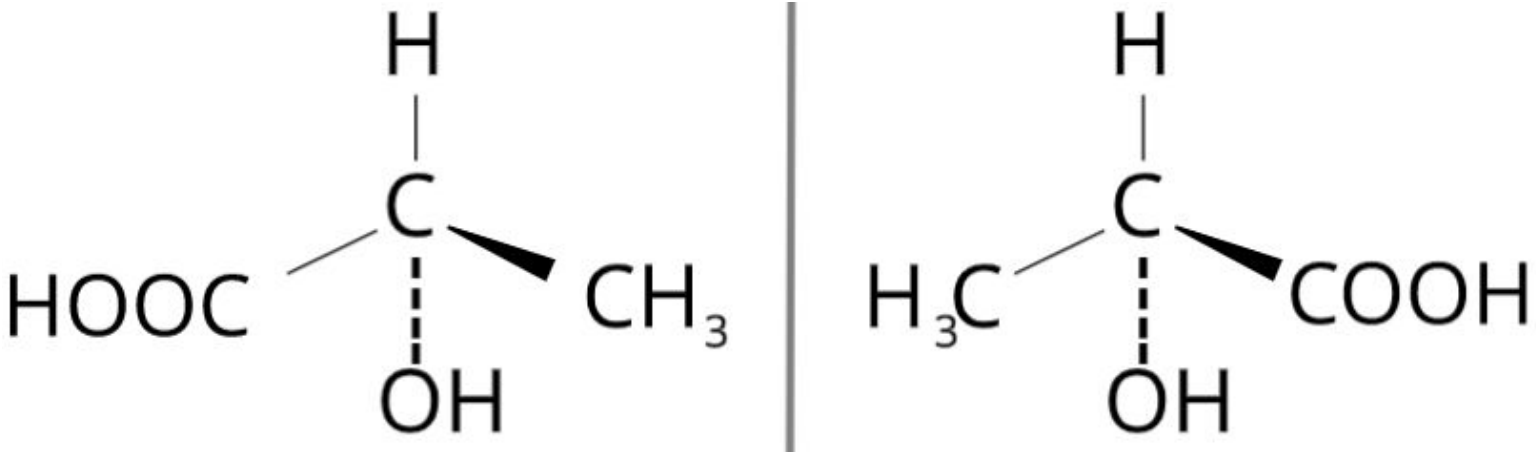
Draw the two enantiomers of 2-hydroxypropanoic acid

Draw one enantiomer and then draw the mirror image next to it:



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Why is optical isomerism a problem for the drug industry?

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Why is optical isomerism a problem for the drug industry?

Often only one enantiomer is effective due to an enzyme's active site/cell receptors being 3D. A reaction can be modified to produce a single enantiomer but it is difficult and expensive.

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Why do reactions involving planar bonds often produce racemates?

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Why do reactions involving planar bonds often produce racemates?

Planar bonds can be attacked by a nucleophile from either above or below. If the carbon has different groups attached to it then two enantiomers will be produced depending on the direction of attack by the nucleophile on the planar bond. A racemic mixture will be produced as there's an equal chance of forming each of the enantiomers.

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