Mr Cole Science

Name: _____ Date: _____

AQA A-LEVEL CHEMISTRY

CIP Priority Rules: Identifying E/Z Isomers

Learn Pack

Guided notes, worked examples and practice questions to be completed alongside the lesson.

WATCH THE LESSON

E/Z Isomerism

Lesson Objectives:

- Know what the Cahn-Ingold-Prelog (CIP) priority rules are.
- Be able to use the CIP priority rules to assign priority to groups and identify E and Z isomers of alkenes.

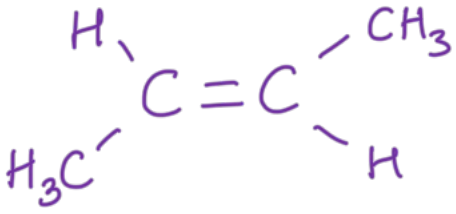
Stereoisomers have the same molecular and structural formula but a different arrangement of atoms in 3-D space.

Geometric or E/Z isomerism is caused by restricted rotation about a carbon-carbon double bond. For E/Z isomerism to exist, each carbon atom in the double bond must be attached to two different groups.

E Isomers

Priority groups are on opposite sides of the double bond.

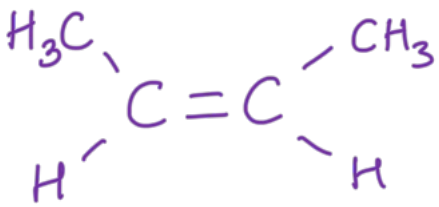
Example: E-but-2-ene



Z Isomers

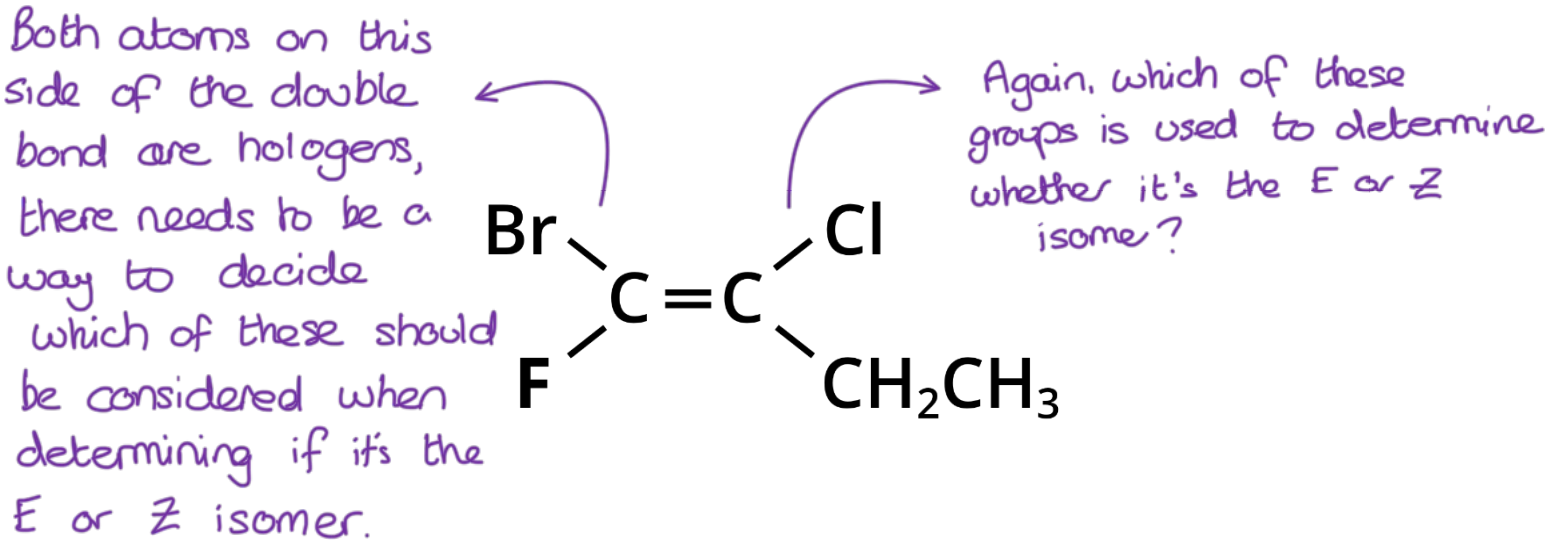
Priority groups are on the same side of the double bond.

Example: Z-but-2-ene



Why do we need CIP Priority Rules?

Annotate the structural formula below to explain why CIP priority rules are needed:



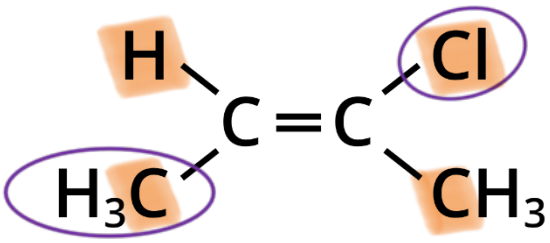
CIP Priority Rules

1. Compare the atoms directly bonded to a carbon atom in the carbon-carbon double bond.
2. The group containing the atom with the higher atomic number is given priority.
3. If the atoms are the same, compare the atoms directly bonded to them.
4. If those atoms are the same, continue comparing equivalent atoms until you reach the first point of difference and assign priority.
5. Repeat the process with the other carbon atom in the double bond.
6. Compare the priority groups to determine whether the molecule is the E isomer or the Z isomer.

Applying the Rules

Circle the priority groups on each side of the double bond, explaining your reasoning. Then identify whether each molecule is the E or Z isomer:

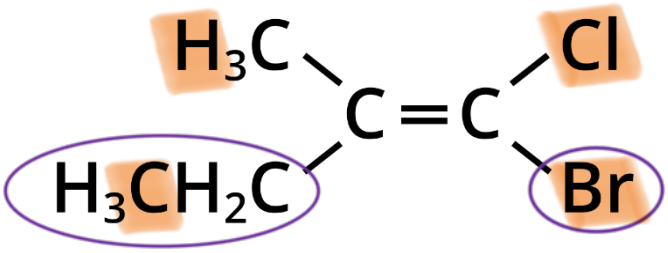
Example 1:



- Carbon has a higher atomic number than hydrogen.
- Chlorine has a higher atomic number than carbon.

E or Z Isomer: E

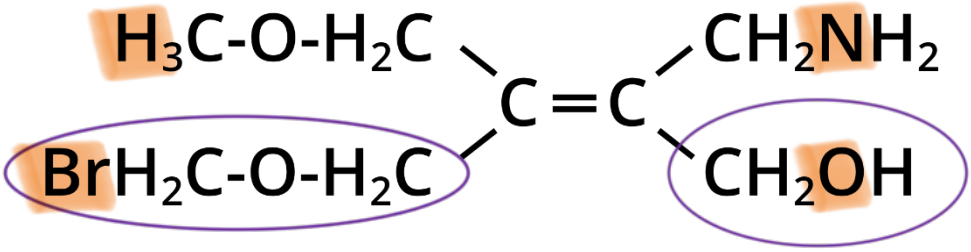
Example 2:



- Carbon has a higher atomic number than hydrogen.
- Bromine has a higher atomic number than chlorine.

E or Z Isomer: Z

Example 3:



- Bromine has a higher atomic number than hydrogen.
- Oxygen has a higher atomic number than nitrogen.

E or Z Isomer: Z

Practise Questions – Fact Recall

1. What is it about carbon-carbon double bonds that allows E/Z isomerism to occur?

   Restricted rotation about the double bond.

2. What condition is required for E/Z isomerism?

   Each carbon atom in the double bond must have two different atoms or groups of atoms attached to it.

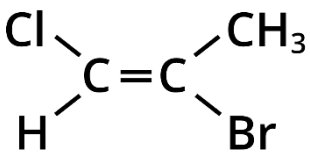
3. When determining priority for E/Z isomers, groups containing atoms with the higher what are given priority?

   Atomic number

Practise Questions – Application

1. For each of the following molecules, complete the table below:

(1)



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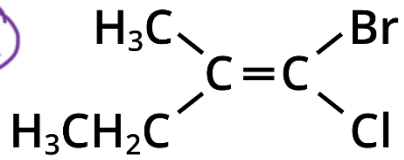

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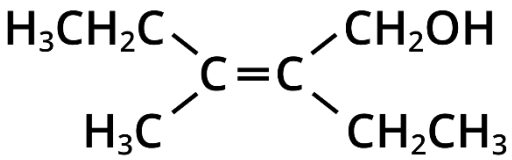

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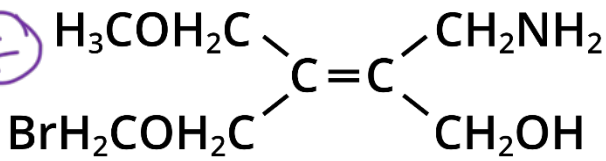

Molecule	Left-hand Priority Group	Right-hand Priority Group	E or Z isomer?
1	Cl	Br	E
2	CH_2CH_3	Br	E
3	CH_2CH_3	CH_2OH	Z
4	CH_2OCH_2Br	CH_2OH	Z