Mr Cole Science

Name: _____ Date: _____

AQA A-LEVEL CHEMISTRY

Structural Isomerism: Chain, Position and Functional Group Isomers

Learn Pack

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

WATCH THE LESSON

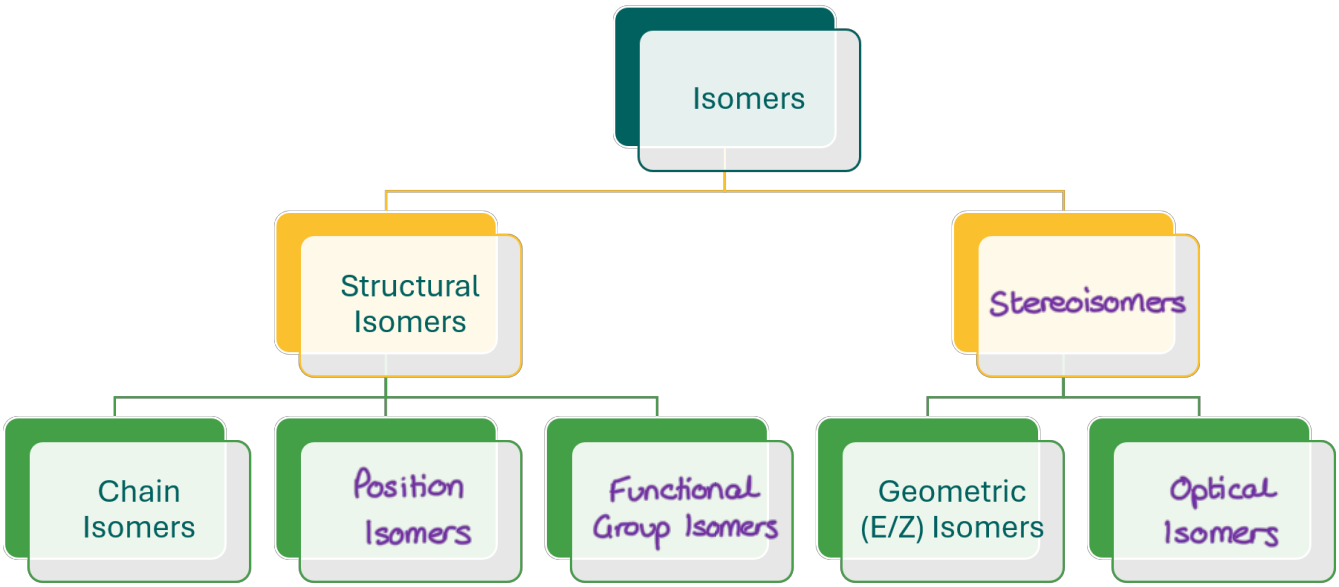
Isomerism

Lesson Objectives:

- Know what isomers are.
- Know what structural isomers are.
- Classify structural isomers as either chain, position or functional group isomers.
- Understand what bond free rotation is.

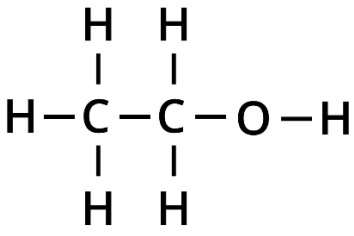
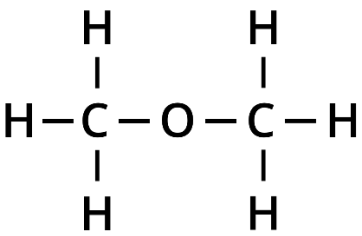
Isomers are molecules that have the same molecular formula but a different arrangement of atoms.

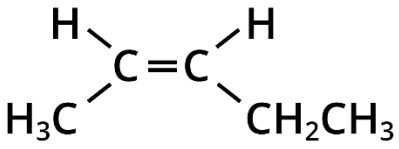
This definition can feel a little vague and so as a consequence scientists classify Isomers into different types depending upon what the differences between the molecules are:

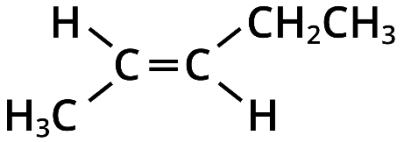


Structural Isomers

Structural isomers have the same molecular formula but a different structural formula.

Substance		
Molecular Formula	C_2H_6O	C_2H_6O
Structural Formula	CH_3CH_2OH	CH_3OCH_3





Explain why these two substances are not structural isomers:

Because they have both the same molecular and structural formulae. Structural isomers have the same molecular formula but a different structural formula.

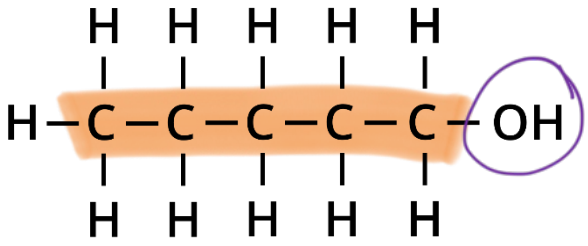
Chain Isomers

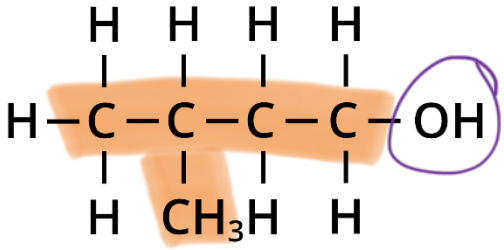
Chain isomers:

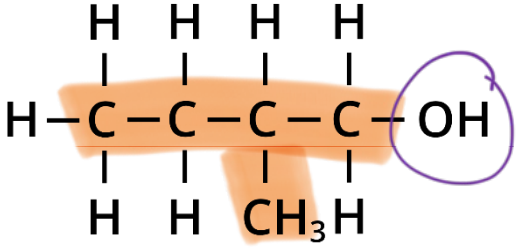
- Contain the same functional group.
- Have different arrangements of the carbon skeleton.

For each of the following substances:

1. Highlight the carbon skeleton.
2. Circle the functional group.





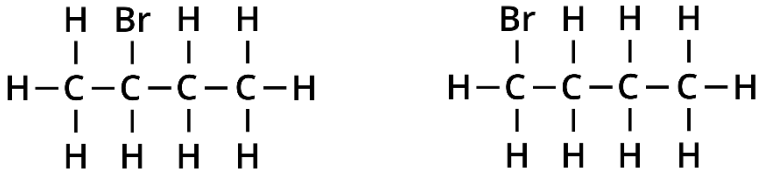
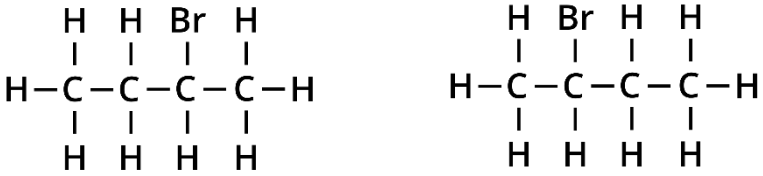


Position Isomers

Position isomers:

- Have the same functional group.
- Have the same carbon skeleton.
- Differ in the location or position of the functional group.

For the following pairs of molecules, decide whether they are position isomers or not:

Molecules	Position Isomers?
	Yes
	No
	Yes

Functional Group Isomers

Functional group isomers have the same atoms arranged into different functional groups.

Common examples:

Homologous Series	Functional Group Isomer
Alkenes	Cycloalkanes
Alcohols	Ethers
Aldehydes	Ketones

Why are pentanal and pentan-2-one functional group isomers rather than position isomers?

Because both aldehydes and ketones contain the carbonyl functional group (C=O) but in aldehydes it is located at the end of the chain whereas in ketones it is somewhere in the middle of the chain.

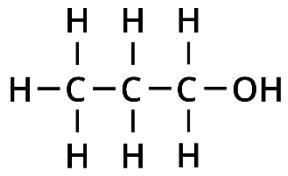
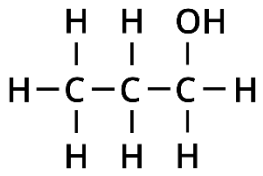
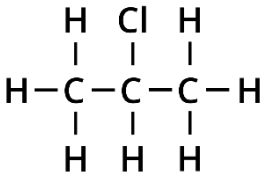
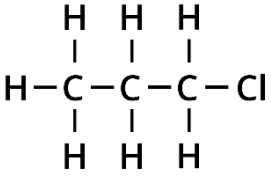
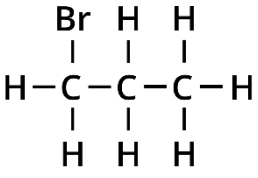
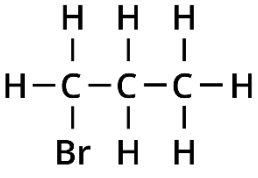
Identifying Structural Isomers

Carbon-carbon single bonds allow: free rotation about the bond

This means that:

One part of the molecule can rotate around the axis of a single covalent bond without breaking that bond.

For the following pairs of molecules, decide whether they are structural isomers or not:

Molecules	Structural Isomers?
 	No
 	Yes
 	No

If you're unsure whether two compounds are structural isomers, you can compare either their structural formula or their IUPAC name.

Practise Questions – Fact Recall

1. What is an isomer?

   Same molecular formula but atoms arranged differently.

2. What are structural isomers?

   Molecules with the same molecular formula but different structural formulas.

3. What are position isomers?

   Same functional group and carbon skeleton but functional group in different location

4. What are functional group isomers?

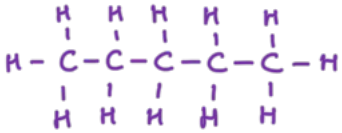
   Same atoms arranged into different functional groups.

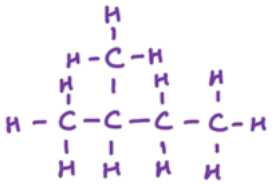
5. What are chain isomers?

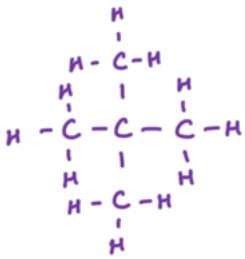
   Same functional group but different carbon skeleton.

Practise Questions – Application

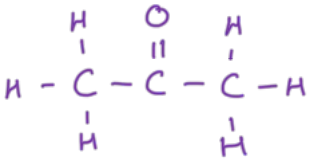
1. Draw all the chain isomers of C_5H_{12}.



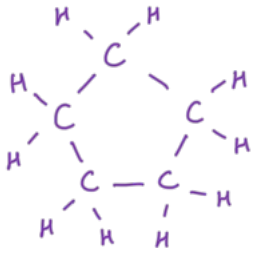




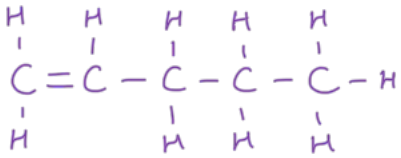
2. Draw a functional group isomer of propanal.



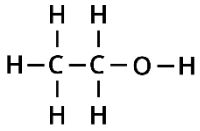
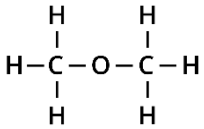
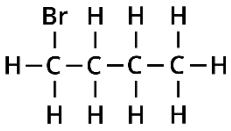
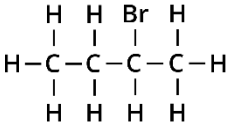
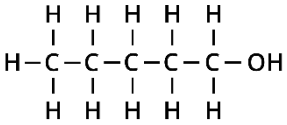
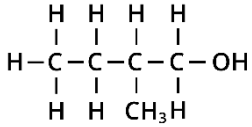
3. Draw a functional group isomer of pent-2-ene.



4. Draw a position isomer of pent-2-ene.



5. State what type of structural isomerism is shown by the following pairs of molecules.

Molecules	Type of Structural Isomerism
 	Functional Group
 	Position
 	Chain