

Structural Isomerism: The Molecular Blueprint

Structural Isomers

Compounds having the **same molecular formula** but different structures (different manners in which atoms are linked).



1. Chain Isomerism



2. Position Isomerism



3. Functional-Group Isomerism



4. Metamerism

Constraint: Always verify identical molecular formulas before evaluating structural differences.

1. Chain Isomerism

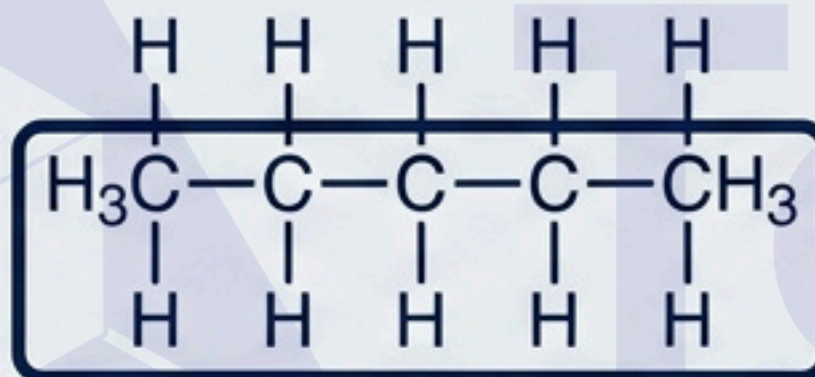
Definition

Isomers with the same molecular formula but different **carbon skeletons**.

Key Insight

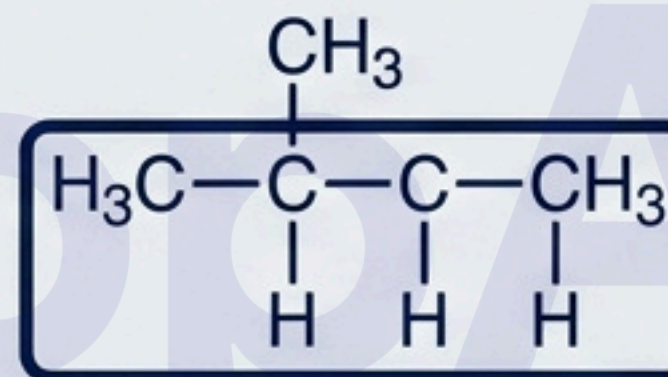
The root word in the IUPAC name changes (pent- vs. but- vs. prop-) because the main carbon chain length physically shortens.

Visual Proof (C₅H₁₂)



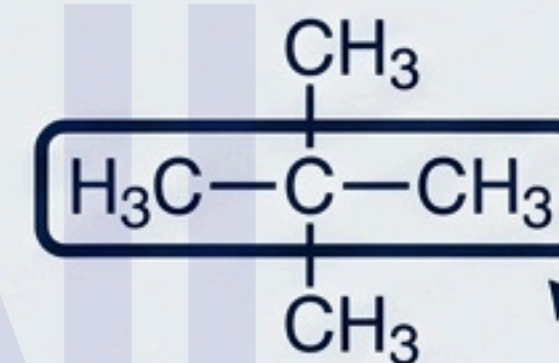
n-Pentane

5-Carbon
Main Chain



Isopentane
(2-Methylbutane)

4-Carbon Main
Chain + 1 Branch



Neopentane
(2,2-Dimethylpropane)

3-Carbon Main
Chain + 2 Branches

2. Position Isomerism

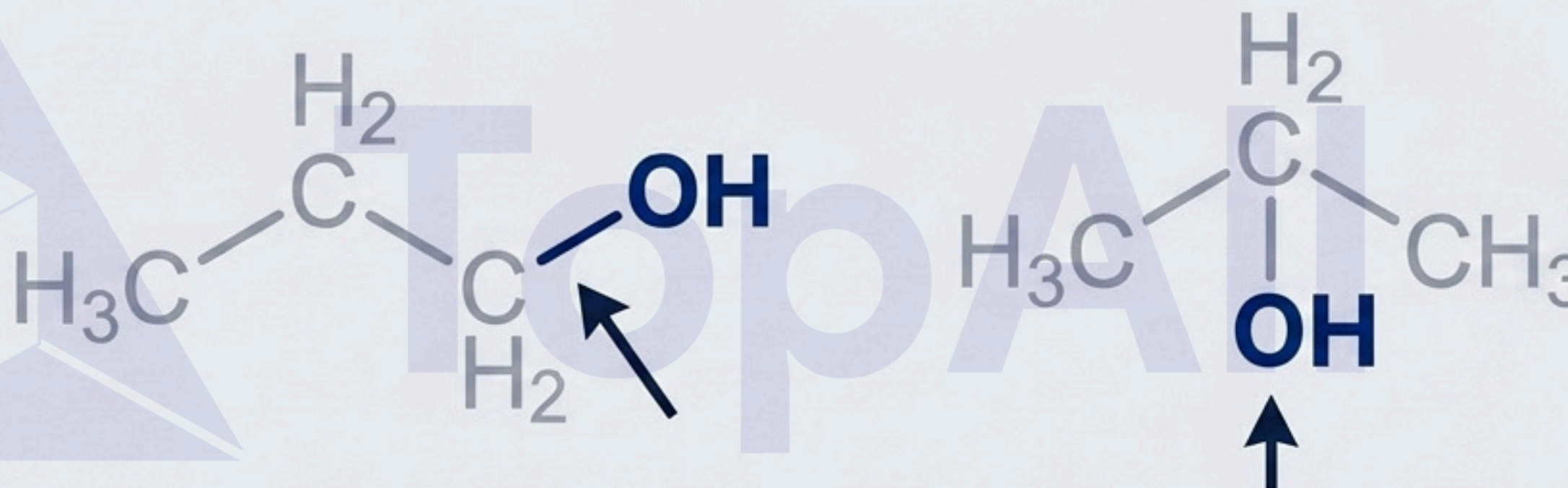
Definition

Differ in the **position** of a substituent atom or functional group on the **same** carbon skeleton.

Key Insight

The carbon skeleton remains identical; only the locant (number) in the IUPAC name shifts.

Visual Proof (C₃H₈O)



Propan-1-ol

-OH group on C1

Propan-2-ol

-OH group shifted to C2



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3. Functional-Group Isomerism

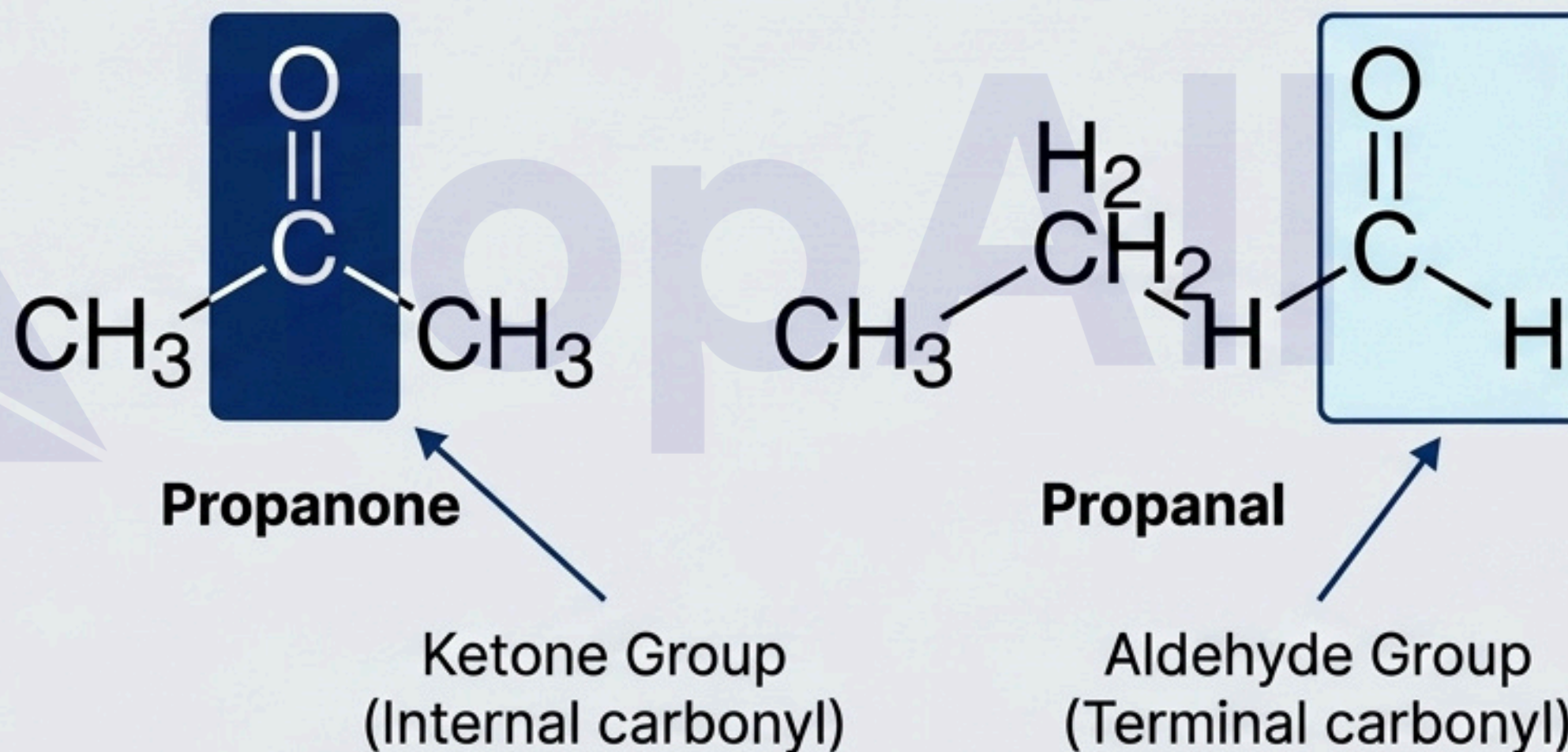
Definition

Same molecular formula, but entirely **different functional groups**.

Key Insight

These isomers belong to completely different homologous series, resulting in drastically different physical and chemical properties.

Visual Proof (C_3H_6O)



4. Metamerism

Definition

Arises due to different **alkyl chains on either side** of a polyvalent functional group.

Key Insight

The functional group itself is unchanged. The variation is strictly in the distribution of carbons across its bridges.

Visual Proof ($C_4H_{10}O$)



←→
Methyl (1C)

←→
Propyl (3C)

Methoxypropane



←→
Ethyl (2C)

←→
Ethyl (2C)

Ethoxyethane

Differentiating Structural Isomers

Isomer Type	Carbon Skeleton	Functional Group Nature	Defining Diagnostic Feature
Chain	Different	Same	Branching or shortening of main carbon chain.
Position	Same	Same	Change in IUPAC locant number of the substituent.
Functional	Variable	Different	Transition to a completely new homologous series.
Metamerism	Variable	Same	Shift in carbon distribution across a polyvalent bridge.

Structural Isomerism: Final Revision Frame

Chain

Skeleton length changes.



Position

Locant shifts on same skeleton.



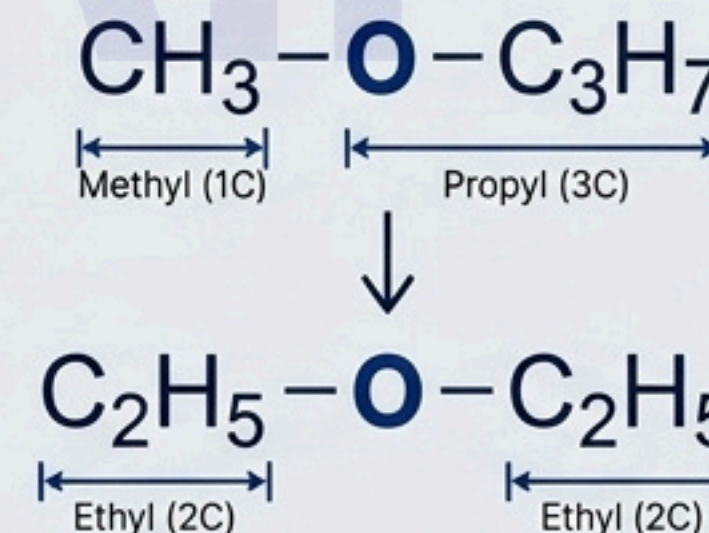
Functional

Entirely different chemical family.



Metamerism

Alkyl distribution across polyvalent atom changes.



CRITICAL FIRST STEP: Always confirm the molecular formulas are exactly identical before categorizing.



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