

[Unit 9] Hydrocarbons

Nomenclature and Isomerism of Alkanes

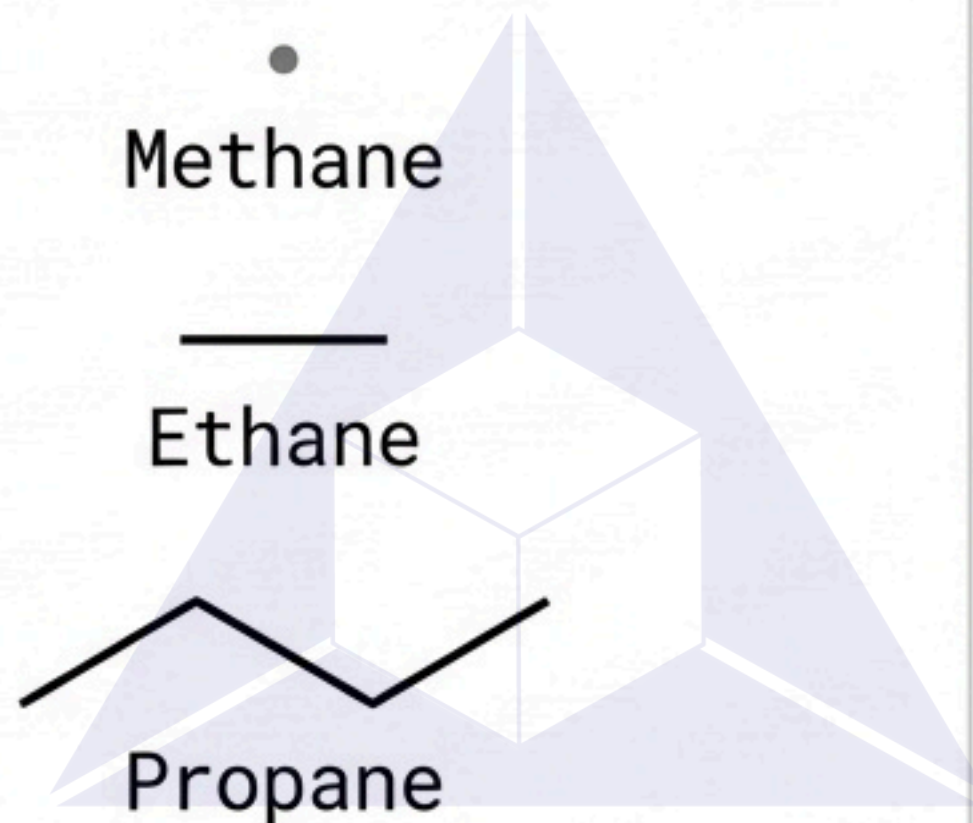
Understanding Alkane Structures, Chain Isomers, and IUPAC Rules.

[Exam Revision]

[Visual Framework]

Why Higher Alkanes Get Interesting

C1 to C3: Only One Path



Isomer Count: 1

Beyond C3: The Branching Explosion

$C_4H_{10} \rightarrow 2$ Isomers

$C_5H_{12} \rightarrow 3$ Isomers

$C_6H_{14} \rightarrow 5$ Isomers

$C_7H_{16} \rightarrow 9$ Isomers

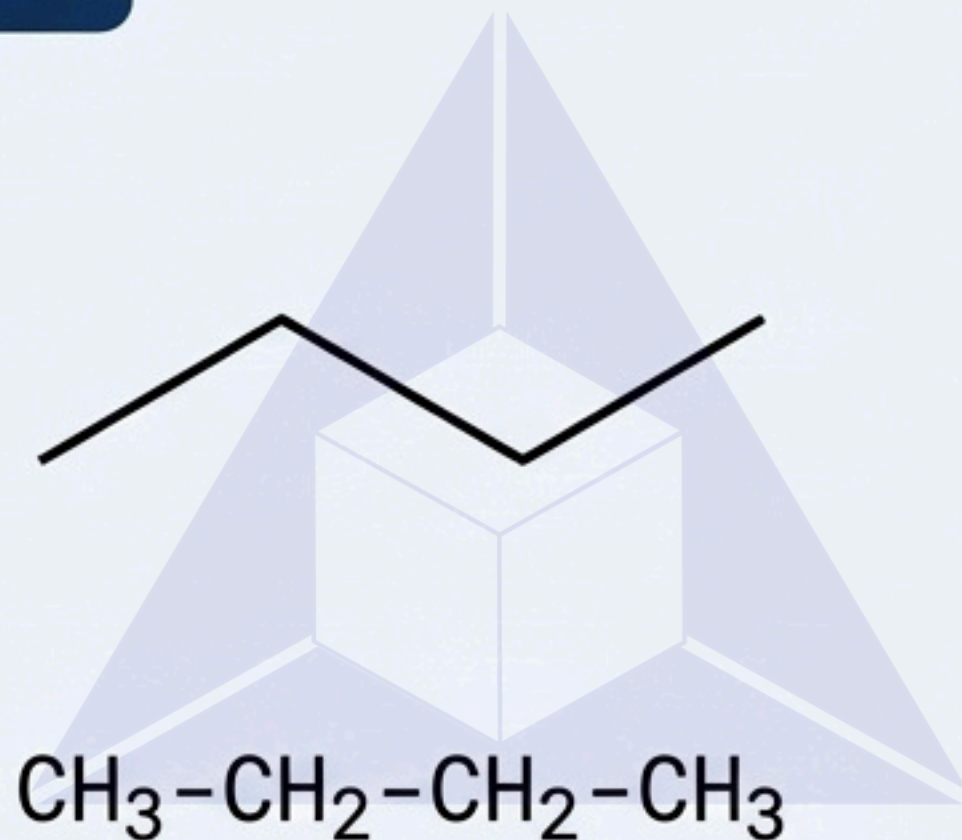
$C_{10}H_{22} \rightarrow 75$ Isomers

Beyond three carbons, atoms can form continuous straight chains OR branched chains, fundamentally changing the molecule's identity and necessitating strict naming rules.

Butane Isomers (C_4H_{10})



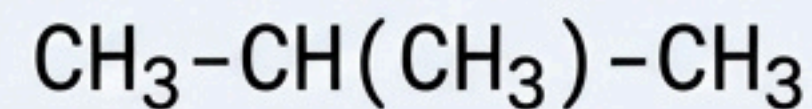
n-butane



Boiling Point: 273 K

isobutane

(2-Methylpropane)



Boiling Point: 261 K

Same molecular formula (C_4H_{10}), but different arrangements yield different physical properties.



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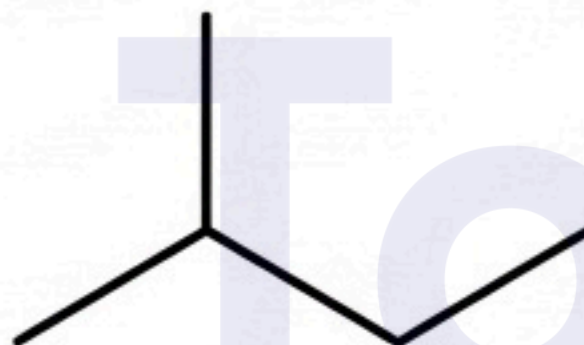
Pentane Isomers (C_5H_{12})

n-pentane



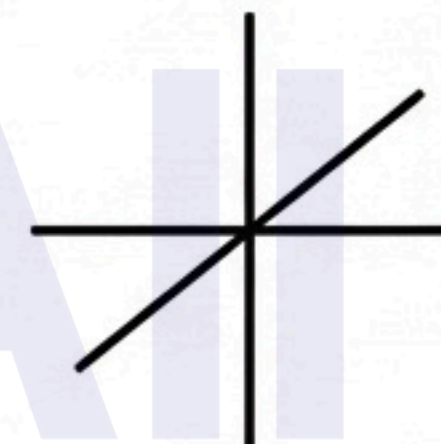
Boiling Point:
309 K (Highest)

isopentane
(2-Methylbutane)



Boiling Point: **301 K**

neopentane
(2,2-Dimethylpropane)



Boiling Point:
282.5 K (Lowest)

[Exam Focus]

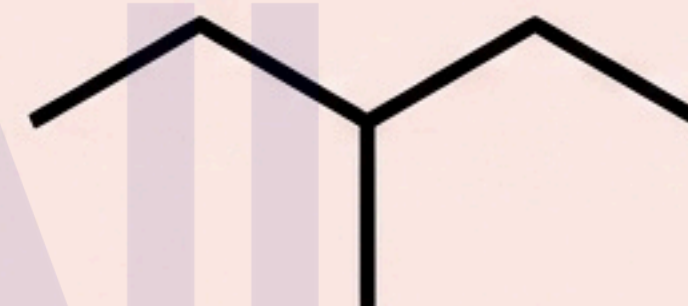
As branching increases, the molecule attains the shape of a sphere. This results in a smaller area of contact, weaker intermolecular van der Waals forces, and a lower boiling point.

Defining Chain Isomerism

Compounds with the same molecular formula but different arrangements of the carbon skeleton.



Continuous Chain



Branched Chain

These are Structural Isomers that differ specifically in their skeletal architecture.

Carbon Type Classification



Primary (1°)

Attached to 1 other carbon.
Terminal carbons are always 1°.

Secondary (2°)

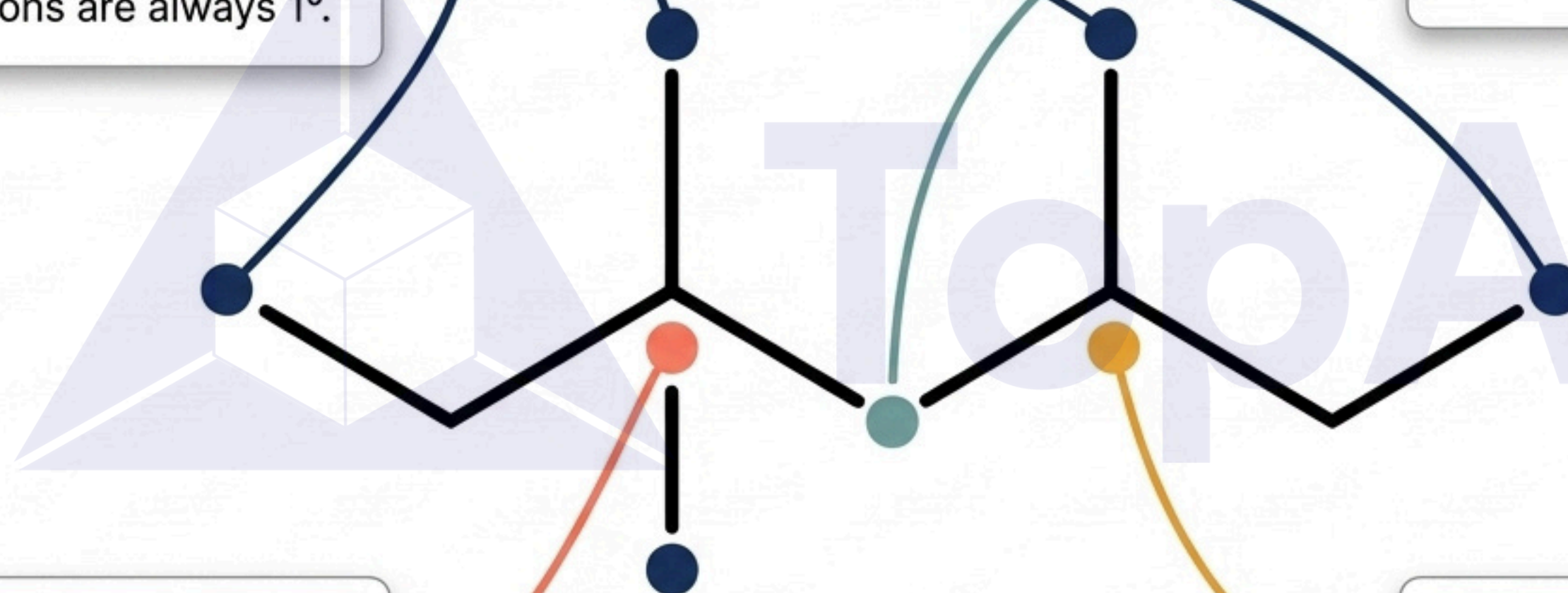
Attached to 2 other carbons.

Quaternary (4° / neo)

Attached to 4 other carbons.

Tertiary (3°)

Attached to 3 other carbons.



2,2,4-trimethylpentane

IUPAC Naming Logic

1

Longest Chain

Identify the parent alkane by finding the longest continuous carbon chain.



2

Numbering

Number the chain to give substituents the lowest possible locants (Lowest Sum Rule).



3

Substituents

Identify alkyl groups (C_nH_{2n+1}).
e.g.,
methyl ($-CH_3$),
ethyl ($-C_2H_5$).

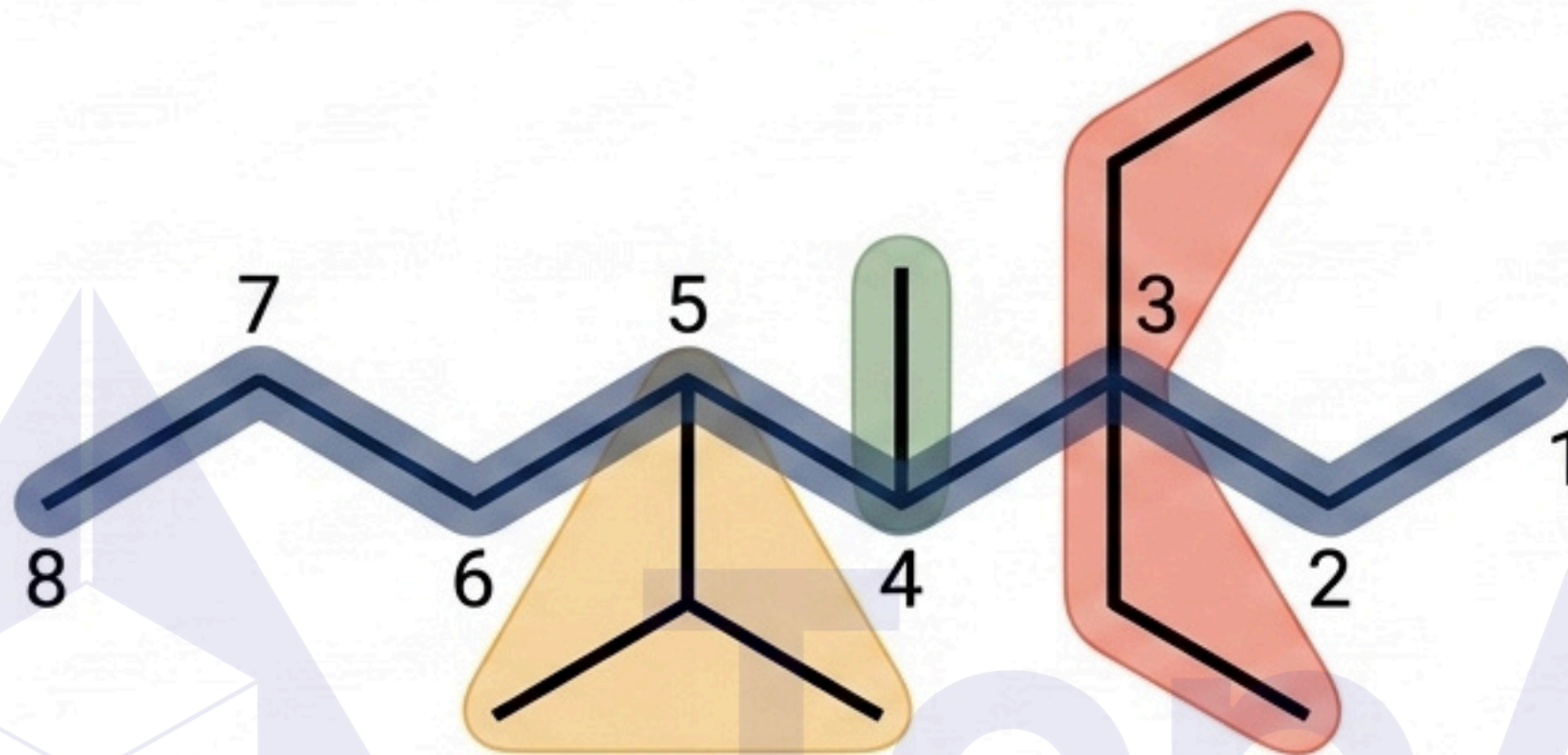


4

Alphabetical Order

Assemble the name alphabetically.
(Note: ignore di/tri/sec/tert, but include iso/neo).

Worked Example: Complex Naming



Parent

Octane (8 carbons)

Substituents

3,3-diethyl, 5-isopropyl,
4-methyl

Alphabetical Sort

Diethyl -> Isopropyl -> Methyl

3,3-Diethyl-5-isopropyl-4-methyloctane

Remember: 'di' is ignored for alphabetical order, but 'iso' is counted. Ethyl comes before Isopropyl!



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