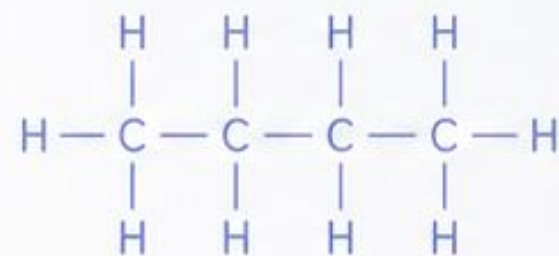


Unit 9

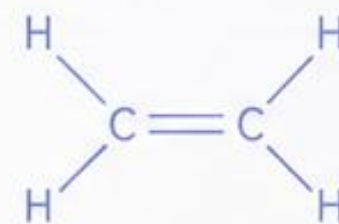
Hydrocarbons



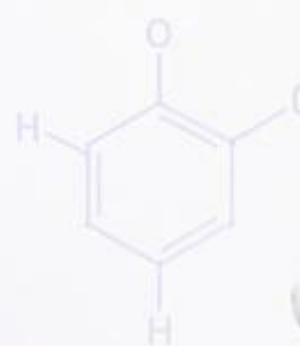
ALKANES



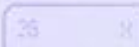
ALKENES



ALKYNES



Chemistry Notes | Class 11



HYDROCARBONS: SCOPE, SOURCES & CLASSIFICATION

WHAT ARE HYDROCARBONS?

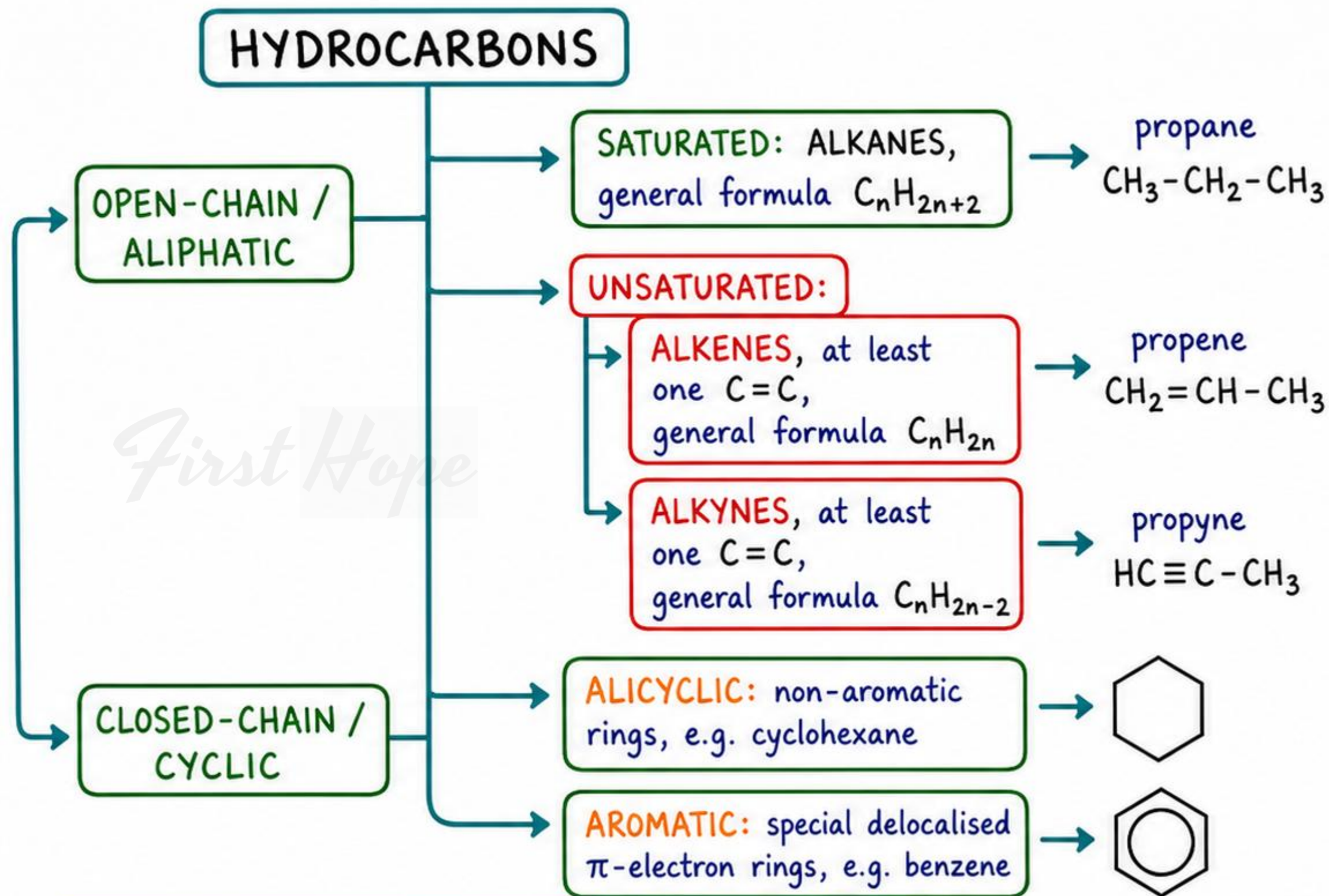
- Hydrocarbons are organic compounds made only of carbon and hydrogen.
- Their carbon atoms join as open chains, branched chains or rings.
- They are important fuels and raw materials for many useful products.

SOURCES & USES

Sources: petroleum, natural gas and coal.

Fuels: LPG, CNG, LNG, petrol, diesel and kerosene.

Uses: polymers, solvents, dyes and medicines.



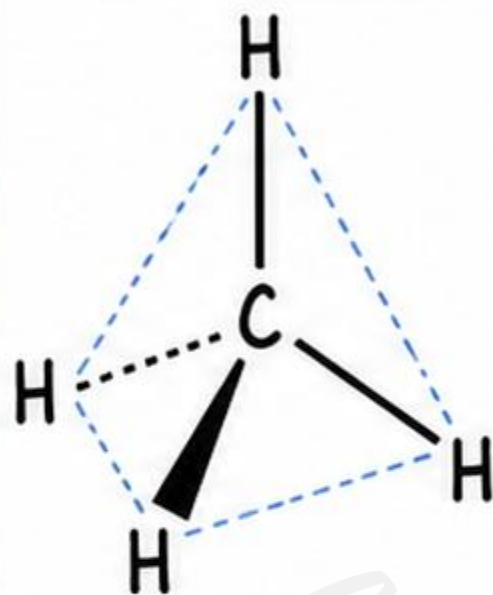
Saturated = only $C-C$ single bonds.

Unsaturated = one or more $C=C$ or $C\equiv C$ bonds.

ALKANES: FORMULA, STRUCTURE & HOMOLOGOUS SERIES

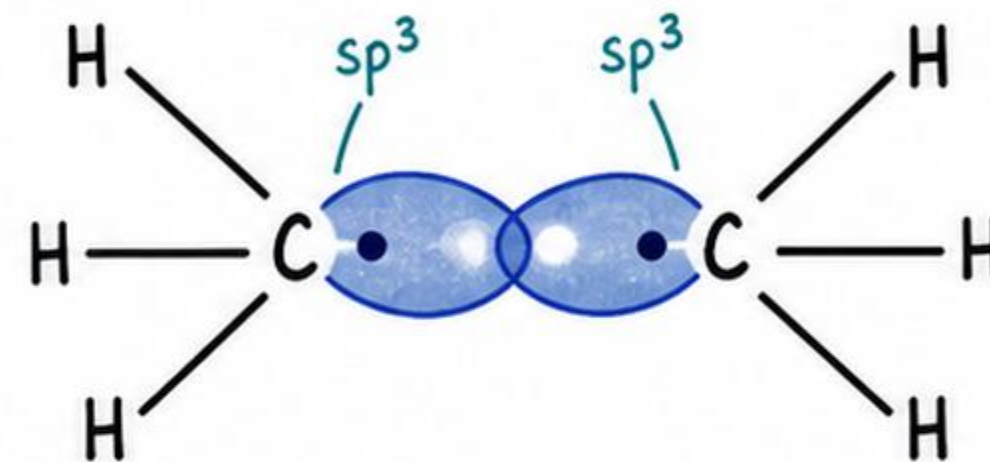
- Alkanes are saturated open-chain hydrocarbons containing only C-C and C-H single bonds.
- General formula: C_nH_{2n+2} , where n = number of carbon atoms.
- They are called paraffins because they are generally less reactive.

METHANE (CH_4) STRUCTURE



- Carbon hybridisation = sp^3
- Geometry = tetrahedral
- H-C-H bond angle = 109.5°
- C-H bond length = 112 pm
- Each C-H bond is a σ bond formed by sp^3-1s overlap.

CARBON-CARBON BOND IN HIGHER ALKANES



- C-C σ bond = sp^3-sp^3 head-on overlap
- C-C bond length = 154 pm

HOMOLOGOUS SERIES OF ALKANES

n	Molecular formula	Name	Condensed structure
1	CH_4	methane	CH_4
2	C_2H_6	ethane	CH_3-CH_3
3	C_3H_8	propane	$CH_3-CH_2-CH_3$
4	C_4H_{10}	butane	$CH_3-CH_2-CH_2-CH_3$
5	C_5H_{12}	pentane	$CH_3(CH_2)_3CH_3$
6	C_6H_{14}	hexane	$CH_3(CH_2)_4CH_3$

TAKEAWAY

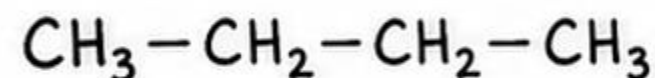
Successive members differ by one $-CH_2-$ unit, so molar mass increases by 14 g mol^{-1} .

ALKANE CHAIN ISOMERISM

Definition: Chain isomerism occurs when compounds have the same molecular formula but different arrangements of the carbon chain.
It begins in alkanes from C_4H_{10} .

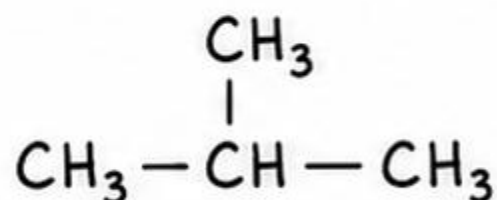
PANEL 1 — C_4H_{10} : TWO ISOMERS

1. Butane (n-butane):



Straight chain

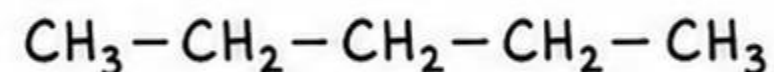
2. 2-Methylpropane (isobutane):



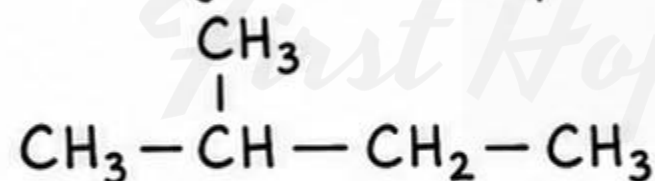
Branched chain

PANEL 2 — C_5H_{12} : THREE ISOMERS

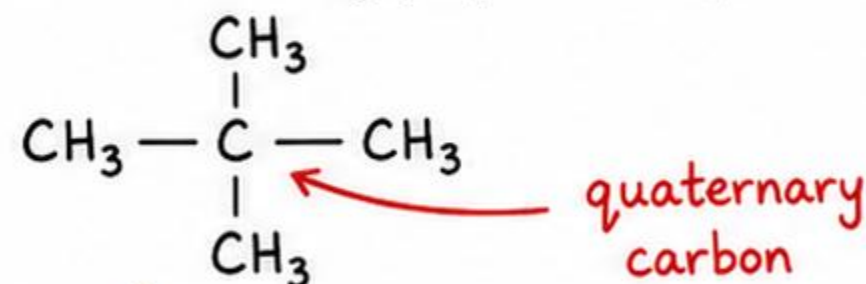
1. Pentane:



2. 2-Methylbutane (isopentane):

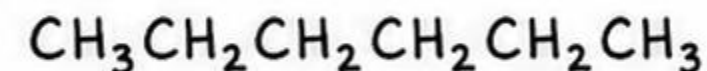


3. 2,2-Dimethylpropane (neopentane):

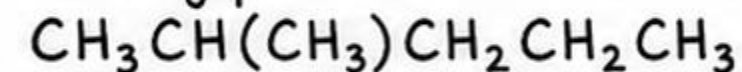


PANEL 3 — C_6H_{14} : FIVE ISOMERS

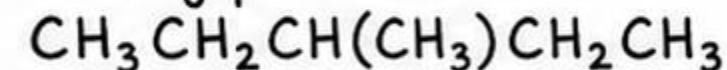
1. Hexane:



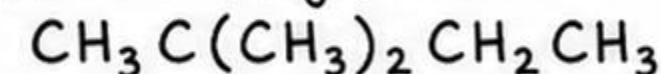
2. 2-Methylpentane:



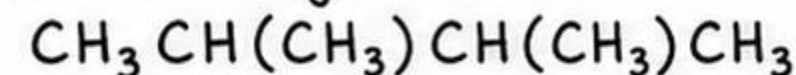
3. 3-Methylpentane:



4. 2,2-Dimethylbutane:



5. 2,3-Dimethylbutane:



TAKEAWAY:

- As the number of carbon atoms increases, the number of possible chain isomers increases rapidly.
- Different isomers can have different physical properties even though their molecular formula is the same.

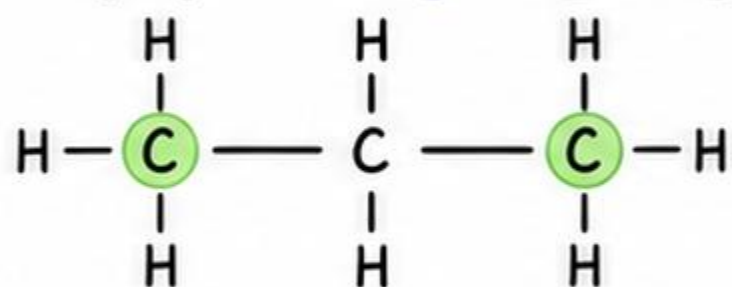
1°, 2°, 3° & 4° CARBON ATOMS

- A carbon atom is classified by the number of OTHER carbon atoms directly attached to it.
- A hydrogen atom is called primary, secondary or tertiary according to the carbon that holds it.
- Important: there is no quaternary hydrogen because a 4° carbon has no H atom.

① PRIMARY CARBON (1°)

Attached to only ONE other carbon.

Example: end CH₃ groups in propane, CH₃-CH₂-CH₃.

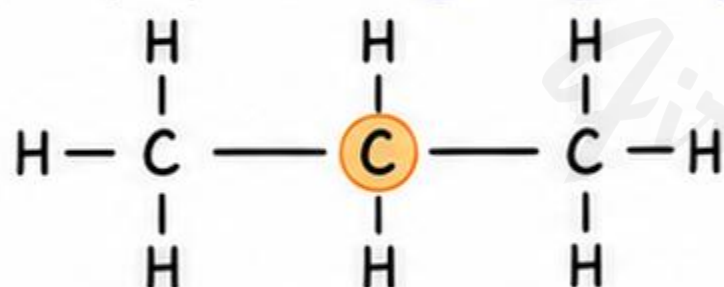


Hydrogens on a 1° carbon are primary hydrogens (1° H).

② SECONDARY CARBON (2°)

Attached to TWO other carbons.

Example: middle CH₂ in propane, CH₃-CH₂-CH₃.

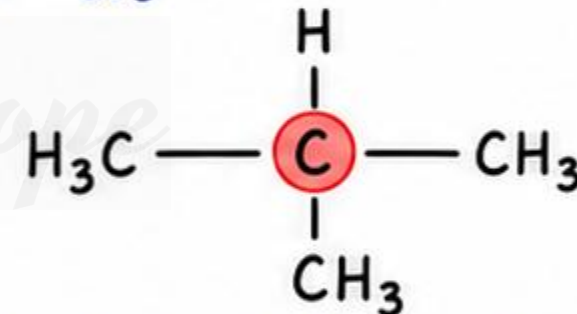


Hydrogens on a 2° carbon are secondary hydrogens (2° H).

③ TERTIARY CARBON (3°)

Attached to THREE other carbons.

Example: 2-methylpropane, (CH₃)₃CH.

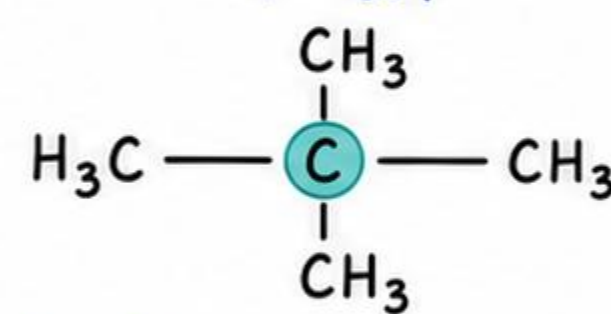


Its single hydrogen is a tertiary hydrogen (3° H).

④ QUATERNARY CARBON (4°)

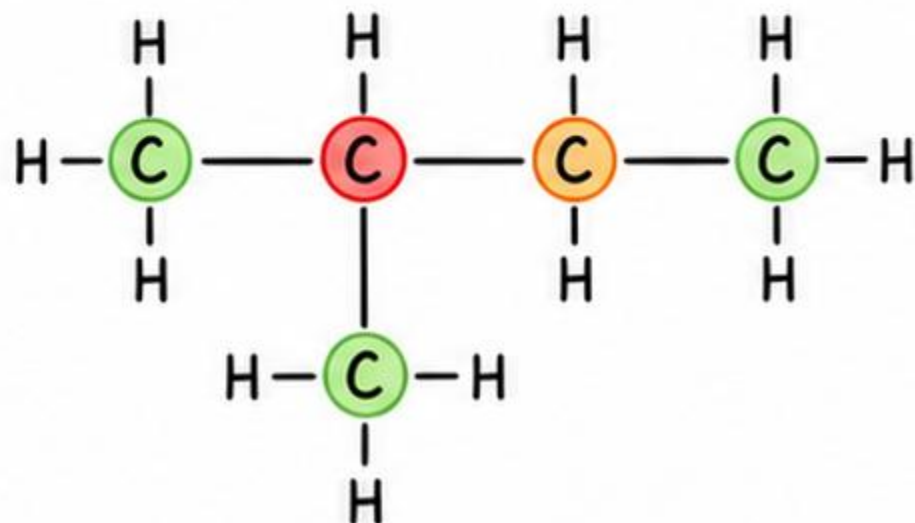
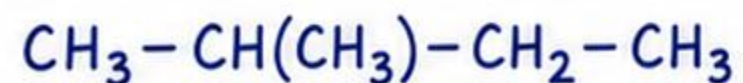
Attached to FOUR other carbons.

Example: 2,2-dimethylpropane, C(CH₃)₄.



A 4° carbon has no hydrogen.

EXAMPLE: 2-METHYLBUTANE



LEGEND (CARBON ATOMS)

- 1° carbon atom (attached to 1 C): 3
- 2° carbon atom (attached to 2 C): 1
- 3° carbon atom (attached to 3 C): 1
- 4° carbon atom (attached to 4 C): 0

HYDROGENS COUNT

Primary H (1° H):	9
Secondary H (2° H):	2
Tertiary H (3° H):	1
Total H atoms:	12

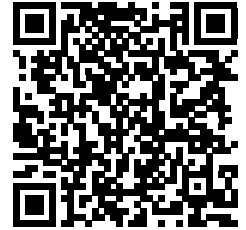


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