

PREFACE

- This is an interactive self learning material exclusively meant for SSLC students of Kerala State Syllabus.
- This work is meant **only for** students appearing SSLC examinations , **march 2021**
- This is strictly in accordance with the Focus points suggested by SCERT
- **Scan the QR codes** given at each section to watch the video, related to the topic.
- You can also watch the videos using mobile,laptop etc by **clicking / touching the QR codes.** Make sure that the data connection is ON.
- Focus Points are marked as **♥♥♥**
- Constructive suggestions for further improvement are always welcome

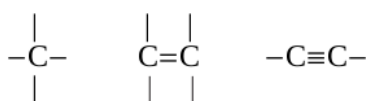
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Nomenclature of organic compounds and isomerism

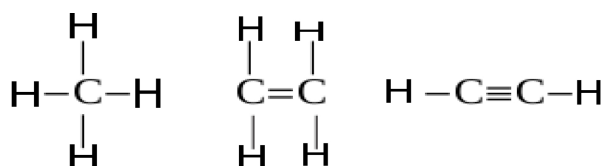


- * Carbon has very high tendency of *catenation* (Ability to make bonds with other carbon atoms).
- * The valency of carbon is 4.
- * It has the ability to form different types of chemical bonds with other elements.

Look at the representation given below.



Imagine that hydrogen atoms are added to these structures. Then we will get the following structures.



Certain organic compounds and their molecular formulae are given here.

Structure of the compound	Molecular Formula
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	C ₂ H ₆
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}=\text{C}-\text{H} \end{array}$	C ₂ H ₄
$\text{H}-\text{C}\equiv\text{C}-\text{H}$	C ₂ H ₂

*What are the characteristics of the compounds given in the table?

They contain carbon and hydrogen only. Hence they are hydrocarbons.

There are compounds having single bond, double bond and triple bond between the carbon atoms. The structure of these compounds can also be written in condensed way as CH₃-CH₃, CH₂=CH₂, CH≡CH. Such a representation is known as **condensed formula**.

♥♥♥♥ **Alkanes**

The open chain hydrocarbons having only **single bond** between the carbon atoms are included in the **Alkane** category.

In alkanes, as all the four valencies of each carbon atom are satisfied by single bonds, they are known as **saturated hydrocarbons**.

1. ♥♥♥♥ Complete the following table.

Number of Carbon atoms	Structure of Alkanes	Condensed formula	Molecular formula
1	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	CH ₄	CH ₄
2	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	CH ₃ -CH ₃	C ₂ H ₆
3	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$	CH ₃ -CH ₂ -CH ₃	C ₃ H ₈
4	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$	CH ₃ -CH ₂ -CH ₂ -CH ₃	C ₄ H ₁₀
5	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$	CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₃	-----
6	-----	-----	C ₆ H ₁₄
7	-----	-----	-----

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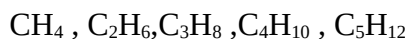
2. ♥♥♥♥ With the help of the table given above, find relationship between the number of atoms of carbon and hydrogen in alkanes.

$$\text{Number of hydrogen atoms} = (2 \times \text{number of carbon atoms}) + 2$$

3. ♥♥♥♥ If an alkane contains 'n' carbon atoms, how many hydrogen atoms will be there?
 $(2 \times n) + 2$

4. ♥♥♥♥ If so, can you deduce a general formula for alkanes? C_nH_{2n+2}

5. ♥♥♥♥ Analyse the following compounds



Certain characteristics of these compounds are given below.

- They can be represented by a general formula.
- Successive members differ by a CH_2 group.
- Members show similarity in chemical properties.
- There is a regular gradation in their physical properties.

A series of such compounds is called a **homologous series**.

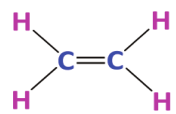
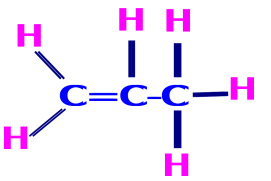
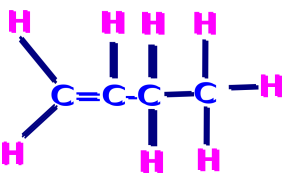
6. ♥♥♥♥ What are unsaturated hydrocarbons?

Hydro carbons having one or more double bond or triple bond between carbon atoms are commonly known as unsaturated hydrocarbons.

♥♥♥♥ **Alkenes**

Hydro carbons having a double bond between any two carbon atoms are considered as Alkenes.

7. ♥♥♥♥ Complete the table given below.

No of Carbon atoms	Structure of the Alkene	Condensed formula	Molecular formula
2		$CH_2=CH_2$	C_2H_4
3		$CH_2=CH-CH_3$	C_3H_6
4		$CH_2=CH-CH_2-CH_3$	C_4H_8
5		$CH_2=CH-CH_2-CH_2-CH_3$	
6		$CH_2=CH-CH_2-CH_2-CH_2-CH_3$	



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8. ♥♥♥♥ Analyse the table above and find the number of hydrogen atoms in an alkene with 'n' carbon atoms.

$$2 \times n$$

9. ♥♥♥♥ If so, can a general formula of alkenes be deduced ? Try to write it.



Alkenes given in the above table are also members of a homologous series.

♥♥♥♥ **Alkynes**

Look at the structure of a hydrocarbon carrying a triple bond between two carbon atoms



Hydrocarbons having a triple bond between any two carbon atoms are named as alkynes.

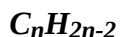
10. ♥♥♥♥ Complete the table given below.

No of Carbon atoms	Structure of the Alkyne	Condensed formula	Molecular formula
2		CH≡CH	C ₂ H ₂
3		CH≡C-CH ₃	C ₃ H ₄
4		CH≡C-CH ₂ -CH ₃	C ₄ H ₆
5		CH≡C-CH ₂ -CH ₂ -CH ₃	
6		CH≡C-CH ₂ -CH ₂ -CH ₂ -CH ₃	

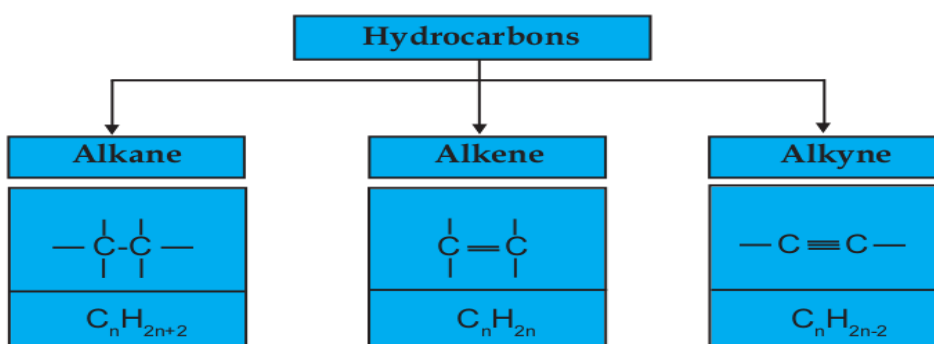
11. ♥♥♥♥ Analyse the table above and find the number of hydrogen atoms in an alkyne with 'n' carbon atoms.

$$(2 \times n) - 2$$

12. ♥♥♥♥ If so, can a general formula of alkenes be deduced ? Try to write it.



Alkynes given in the above table are also members of a homologous series.



♥♥♥ Nomenclature of hydrocarbons

IUPAC has put forward some rules for the naming of organic compounds. While naming hydrocarbons, the following basic points should be considered

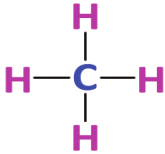
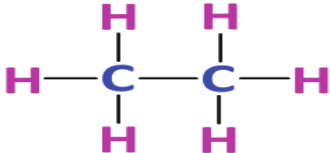
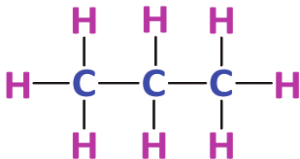
1. Number of carbon atoms
2. Nature of the chemical bond between the carbon atoms.

Word roots are selected based on the number of carbon atoms.

Number of carbon atoms	Word Root
C ₁	Meth
C ₂	Eth
C ₃	Prop
C ₄	But
C ₅	Pent
C ₆	Hex
C ₇	Hept
C ₈	Oct
C ₉	Non
C ₁₀	Dec

♥♥♥ Nomenclature of Unbranched Alkanes.

Examine the given structural formula, molecular formula and IUPAC names of some alkanes.

Structural formula	Molecular formula	IUPAC name
	CH ₄	Methane
	C ₂ H ₆	Ethane
	C ₃ H ₈	Propane

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► How are the names derived from the word roots?

Alkanes are named by adding the suffix 'ane' along with the word root that denotes the number of carbon atoms.

Meth + ane → Methane

Eth + ane → Ethane

Prop + ane → Propane

Word root + ane → Alkane

13. ♥♥♥ Write the IUPAC name of the following alkanes.

Condensed formula	IUPAC Name
CH ₃ -CH ₂ -CH ₂ -CH ₃	
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₃	
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	

Answer:

Condensed formula	IUPAC Name
CH ₃ -CH ₂ -CH ₂ -CH ₃	Butane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Pentane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Hexane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Heptane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Nonane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Decane

14. ♥♥♥ Complete the following table

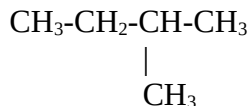
Condensed formula	IUPAC Name
.....	Propane
.....	Octane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃

Answer:

Condensed formula	IUPAC Name
CH ₃ -CH ₂ -CH ₃	Propane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Octane
CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃	Decane

♥♥♥ **Nomenclature of Branched Hydrocarbons**

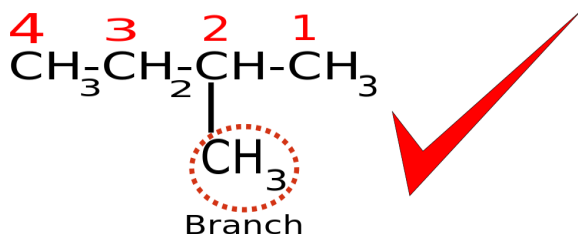
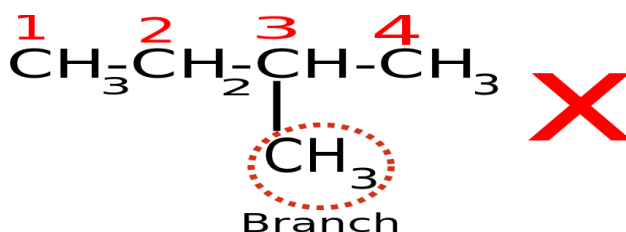
Consider the following compound



According to the IUPAC rules of nomenclature, the longest chain (with the maximum number of carbon atoms) should be considered as the main chain and the remaining carbon atoms are treated as branches. The position of the branches can be found out by numbering carbon atoms in the main chain.

Numbering of the carbon atoms in the chain should be done in such a way that the carbon atom carrying the branch gets the lowest number.

Hence the numbering should be done in the following way.



After understanding the correct numbering, go through the following points.

- | | |
|--|-------------------|
| a) Number of carbon atoms in the main chain | : 4 |
| b) Word root | : But |
| c) Suffix | : <i>ane</i> |
| d) Name of the alkyl radical coming as branch | : Methyl |
| e) Position of the branch | : 2 |
| f) IUPAC name | : 2-Methyl butane |

Position number of branch + hyphen + name of radical(branch) + word root + suffix.

A hyphen (-) is used to separate numerals and alphabets while writing the IUPAC name.

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15. ♥♥♥ Write IUPAC names of the hydrocarbons given below.

Compound	Number of carbon atoms in the longest chain	Name of branch	Position of branch	IUPAC name
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH}_2 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_3 \\ & & & & & & & & \\ & & & & & & \text{CH}_3 & & \end{array}$
$\begin{array}{ccccccc} & & & & \text{CH}_3 & & & & \\ & & & & & & & & \\ \text{CH}_3 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \end{array}$
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & & & \\ & & & & \text{CH}_2 & & & & \\ & & & & & & & & \\ & & & & \text{CH}_3 & & & & \end{array}$
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & \\ & & \text{CH}_2 & & & & \\ & & & & & & \\ & & \text{CH}_3 & & & & \end{array}$

Answer:

Compound	Number of carbon atoms in the longest chain	Name of branch	Position of branch	IUPAC name
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH}_2 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_3 \\ & & & & & & & & \\ & & & & & & \text{CH}_3 & & \end{array}$	5	Methyl	2	2- Methylpentane
$\begin{array}{ccccccc} & & & & \text{CH}_3 & & & & \\ & & & & & & & & \\ \text{CH}_3 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \end{array}$	5	Methyl	3	3- Methyl pentane
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & & & \\ & & & & \text{CH}_2 & & & & \\ & & & & & & & & \\ & & & & \text{CH}_3 & & & & \end{array}$	5	Ethyl	3	3- Ethyl pentane
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & \\ & & \text{CH}_2 & & & & \\ & & & & & & \\ & & \text{CH}_3 & & & & \end{array}$	5	Methyl	3	3- Methylpentane

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More practice questions.

16. ♥♥♥♥ Write the IUPAC names of the following .

Compound	Number of carbon atoms in the longest chain	Name of branch	Position of Branch	IUPAC Name
$\begin{array}{c} \text{CH}_3\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$				
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_3 \\ \\ \text{CH}_3 \end{array}$				
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH-CH}_3 \\ \\ \text{CH}_3 \end{array}$				
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$				
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$				
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_3 \\ \\ \text{CH}_2\text{-CH}_3 \end{array}$				
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_2 \\ \\ \text{CH}_3 \end{array}$				

While naming a branch it is better to have knowledge about alkyl groups.

Alkyl groups are obtained by removing a hydrogen atom from alkanes

Alkane	Alkyl group
Methane CH ₄	Methyl CH ₃ -
Ethane C ₂ H ₆	Ethyl C ₂ H ₅ - or CH ₃ -CH ₂ -
Propane C ₃ H ₈	Propyl C ₃ H ₇ - or CH ₃ -CH ₂ -CH ₂ -

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Answer:

Compound	Number of carbon atoms in the longest chain	Name of branch	Position of Branch	IUPAC Name
$\begin{array}{c} \text{CH}_3\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$	4	Methyl	2	2-Methylbutane
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_3 \\ \\ \text{CH}_3 \end{array}$	5	Methyl	2	2-Methylpentane
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH-CH}_3 \\ \\ \text{CH}_3 \end{array}$	6	Methyl	2	2-Methylhexane
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$	6	Methyl	3	3-Methylhexane
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$	6	Methyl	3	3-Methylhexane
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_3 \\ \\ \text{CH}_2\text{-CH}_3 \end{array}$	6	Ethyl	3	3-Ethylhexane
$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_2 \\ \\ \text{CH}_3 \end{array}$	6	Ethyl	3	3-Ethyl hexane

17. ♥♥♥♥ Complete the table.

IUPAC Name	Structural formula
2 – Methyl Propane	
3 – Methyl heptane	
3 – Ethyl Octane	
4– Ethyl Decane	

Answer:

IUPAC Name	Structural formula
2 – MethylPropane	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{-CH-CH}_3 \end{array}$
3 – Methylheptane	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3 \end{array}$
3 – Ethyloctane	$\begin{array}{c} \text{CH}_2\text{-CH}_3 \\ \\ \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3 \end{array}$
4– Ethyldecane	$\begin{array}{c} \text{CH}_2\text{-CH}_3 \\ \\ \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3 \end{array}$

Recommendations for the nomenclature of branched hydrocarbons

- Find out the main chain and identify the branch/branches.
- Numbering should be done from the end in which the branch occurs.

♥♥♥♥ **Nomenclature of unsaturated Hydrocarbons**

18. ♥♥♥♥ Classify and tabulate the following compounds into alkanes, alkenes and alkynes.

C_5H_{10} , C_6H_{10} , C_2H_4 , C_5H_{12} , C_6H_{12} , C_7H_{12} , $C_{10}H_{22}$, C_4H_{10} , C_4H_8 , C_4H_6 , C_2H_6 , C_3H_6 , C_2H_2 , C_3H_4 , C_3H_8 .

Answer:

Alkane	Alkene	Alkyne
C_5H_{12}	C_5H_{10}	C_6H_{10}
$C_{10}H_{22}$	C_2H_4	C_7H_{12}
C_4H_{10}	C_6H_{12}	C_4H_6
C_2H_6	C_4H_8	C_2H_2
C_3H_8	C_3H_6	C_3H_4



26. Write the structural formula of the compound C_2H_4

Answer: $CH_2=CH_2$

19. ♥♥♥♥ What is the IUPAC name of the compound $CH_2=CH_2$?

(Hint : Replace the 'ane' in the IUPAC name of the alkane with 'ene'. Alk + ene = alkene)

Answer: The IUPAC name of the compound is Ethene.

More examples:

20. ♥♥♥♥ What is the IUPAC name of the compound $CH_3-CH=CH_2$?

Answer: Propene.

21. ♥♥♥♥ What is the IUPAC name of the compound $CH_2=CH-CH_2-CH_3$?

If your answer is Butene, then ,what is the IUPAC name of $CH_3-CH=CH-CH_3$? Is it Butene?

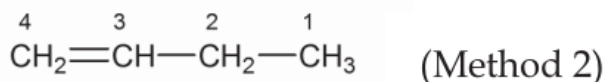
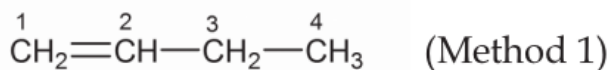
Look at the difference in the position of the double bond .

For unbranched, unsaturated hydrocarbons with four or more carbon atoms, position number of the doubly bonded carbon atom should be indicated.

Then ,

What is the IUPAC name of the compound $CH_3-CH_2-CH=CH_2$?

Let's go through this example



While numbering the carbon atoms, during IUPAC naming, **the carbon atoms linked by double bond should be given the lowest position number.**

Accordingly, it is in **method (1)** that the lowest position numbers are given to the doubly bonded carbon atoms. What will be the IUPAC name of the compound then?

Answer: But-1-ene

22. ❤❤❤❤ What is the structure of **But-2-ene** ?

Answer: $\text{CH}_3\text{-CH=CH-CH}_3$

23. ❤❤❤❤. What is the IUPAC name of $\text{CH}_3\text{-CH}_2\text{-CH=CH-CH}_3$?

Answer: Pent-2-ene

24. ❤❤❤❤ What is the IUPAC name of $\text{CH}_3\text{-CH=CH-CH}_2\text{-CH}_3$?

Answer: Pent-2-ene.

For naming alkynes , the same method has to be followed . Alk + yne = Alkyne.

25. ❤❤❤❤ What is the IUPAC name of $\text{CH}\equiv\text{CH}$?

Answer: Ethyne

26. ❤❤❤❤ What is the IUPAC name of $\text{CH}_3\text{-C}\equiv\text{CH}$?

Answer: Propyne

27. ❤❤❤❤ What is the IUPAC name of $\text{CH}_3\text{-CH}_2\text{-C}\equiv\text{CH}$?

Answer: But-1-yne

28. ❤❤❤❤ What is the structure of **But-2-yne** ?

Answer: $\text{CH}_3\text{-C}\equiv\text{C-CH}_3$

29. ❤❤❤❤ What is the structure of **Pent-2-yne** ?

Answer: $\text{CH}_3\text{-CH}_2\text{-C}\equiv\text{C-CH}_3$ **OR** $\text{CH}_3\text{-C}\equiv\text{C-CH}_2\text{-CH}_3$

♥♥♥ Functional groups.

Carbon and hydrogen are not the only elements present in organic compounds. There are other atoms and groups of atoms present in the place of hydrogen atoms in organic compounds.



The presence of certain atoms or groups imparts certain characteristic properties to organic compounds. They are called functional groups. Some important functional groups are given below.

Sl No	Functional group	Structure	Name	IUPAC Name
1	♥♥♥ Hydroxyl group	-OH	Alcohol	Alkanol
2	♥♥♥ Alkoxy group	- O - R	Ether	Alkoxyalkane

(R – Alkyl groups like CH₃-, CH₃-CH₂-, CH₃-CH₂-CH₂- or Aryl groups like C₆H₅-)

1. ♥♥♥ Hydroxyl Group (- OH)

IUPAC Name : Alkane - e + ol → Alkanol

30. ♥♥♥ What is the IUPAC name of CH₃-OH?

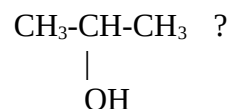
Answer: Methane-e+ ol = **Methanol**

39. ♥♥♥ What is the IUPAC name of CH₃-CH₂-OH?

Answer: Ethanol

31. ♥♥♥ What is the IUPAC name of CH₃-CH₂-CH₂-OH?

Is it Propanol ? If yes, then , what is the IUPAC name of



CH₃-CH₂-CH₂-OH is Propan-1-ol

$$\begin{array}{c} \text{CH}_3\text{-CH-CH}_3 \\ | \\ \text{OH} \end{array}$$
 is Propan-2-ol

32. ♥♥♥ What is the IUPAC name of CH₃-CH₂-CH₂-CH₂-OH?

Answer : Butan-1-ol

33. ♥♥♥ What is the IUPAC name of CH₃-CH-CH₂-CH₃ ?



Answer : Butan-2-ol

34. ♥♥♥ What is the IUPAC name of CH₃-CH₂-CH-CH₃ ?



Answer : Butan-2-ol

(The main chain should be numbered from the end nearest to the functional group.)

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35. ♥♥♥♥ What is the structural difference between $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$ and $\text{CH}_3\text{-CH-CH}_3$?



Answer: The position of functional group is different.

2. ♥♥♥♥ Alkoxy Group (- R-O)

Ethers are compounds with an alkoxy group.

IUPAC Name: Alkoxy alkane

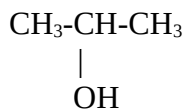
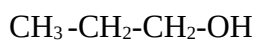
Examples are given below.

Sl No	Ether	IUPAC name
1	$\text{CH}_3\text{-O-CH}_3$	Methoxymethane
2	$\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$	Ethoxyethane
3	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$	Propoxypropane
4	$\text{CH}_3\text{-O-CH}_2\text{-CH}_3$	<i>Methoxyethane</i>
5	$\text{CH}_3\text{-CH}_2\text{-O-CH}_3$	<i>Methoxyethane</i>
6	$\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$	Ethoxypropane
7	$\text{CH}_3\text{-O-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	Methoxybutane
8	$\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$	Ethoxypropane
9	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$	Ethoxybutane
10	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-O-CH}_3$	Methoxybutane

Here among the alkyl radicals on either side of the -O- group, the **longest alkyl group is taken as alkane** and the other as alkoxy group. Look at the above table one again and verify

♥♥♥ **Isomerism**

♥♥♥ Look at the following compounds.



• ♥♥♥♥ What are the similarities between these two compounds?

Number of carbon atoms	3
Number of hydrogen atoms	8
Number of oxygen atoms	1
Functional Group	-OH
Molecular formula	C₃H₈O

• ♥♥♥♥ What is the difference between them?

The the position of the functional group differs.

These compounds are different even though they have the same molecular formula.

They are known as Isomers. Isomers show different physical and chemical properties though the molecular formula is the same.

Compounds having same molecular formula but different chemical and physical properties are called Isomers. The phenomenon is called Isomerism.

♥♥♥♥ **Three types of Isomerism have been discussed here.**

1. Chain Isomerism
2. Position Isomerism
3. Functional Isomerism

♥♥♥♥ **1.Chain Isomerism**

Compounds with the same molecular formula but possess a difference in the chain structure are called 'Chain isomers'.

Examples

1.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$	$\begin{array}{c} \text{CH}_3\text{-CH-CH}_3 \\ \\ \text{CH}_3 \end{array}$
<i>Molecular formula</i>	C_4H_{10}	C_4H_{10}
<i>IUPAC Name</i>	Butane	2-Methylpropane
<i>Reason for different properties</i>	Difference in chain structure.	



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2.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	$\begin{array}{c} \text{CH}_3\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{-C-CH}_3 \\ \\ \text{CH}_3 \end{array}$
<i>Molecular formula</i>	C_5H_{12}	C_5H_{12}	C_5H_{12}
<i>IUPAC Name</i>	Pentane	2-Methylbutane	2,2-Dimethylpropane
<i>Reason for different properties</i>	Difference in chain structure.		

36. ♥♥♥♥ (a) How many chain isomers are possible for $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$?

Answer: 5

(b) Give their structures

Answer: Self Assessment

(c) Write their IUPAC names

Answer:

Hexane , 2-Methylpentane, 3-Methylpentane,
2,2- Dimethylbutane, 2,3- Dimethylbutane

2♥♥♥♥. **Position Isomerism**

If the position of the functional group is different in compounds having the same molecular formula and the same functional group, then they are position Isomers.



Examples

1.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$	$\begin{array}{c} \text{CH}_3\text{-CH-CH}_3 \\ \\ \text{OH} \end{array}$
<i>Molecular formula</i>	$\text{C}_3\text{H}_8\text{O}$	$\text{C}_3\text{H}_8\text{O}$
<i>IUPAC Name</i>	Propan-1-ol	Propan-2-ol
<i>Reason for different properties</i>	<i>Position of the functional group is different</i>	

2.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-Cl}$	$\begin{array}{c} \text{CH}_3\text{-CH-CH}_3 \\ \\ \text{Cl} \end{array}$
<i>Molecular formula</i>	$\text{C}_3\text{H}_7\text{Cl}$	$\text{C}_3\text{H}_7\text{Cl}$
<i>IUPAC Name</i>	1-Chloropropane	2-Chloropropane
<i>Reason for different properties</i>	<i>Position of the functional group is different</i>	

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3.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH}$	$\begin{array}{c} \text{CH}_3\text{-CH-CH}_2\text{-CH}_2\text{-CH}_3 \\ \\ \text{OH} \end{array}$	$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH-CH}_2\text{-CH}_3 \\ \\ \text{OH} \end{array}$
<i>Molecular formula</i>	$\text{C}_5\text{H}_{12}\text{O}$	$\text{C}_5\text{H}_{12}\text{O}$	$\text{C}_5\text{H}_{12}\text{O}$
<i>IUPAC Name</i>	Pentan-1-ol	Pentan-2-ol	Pentan-3-ol
<i>Reason for different properties</i>	<i>Position of the functional group is different</i>		

37. Write the structure of the position isomer of Butan-1-ol

Answer : $\text{CH}_3\text{-CH-CH}_2\text{-CH}_3$



3.♥♥♥ Functional Isomerism

Compounds having same molecular formula, but having a difference in their functional groups, are known as 'Functional isomers'.



Examples

1.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-OH}$	$\text{CH}_3\text{-O-CH}_3$
<i>Molecular formula</i>	$\text{C}_2\text{H}_6\text{O}$	$\text{C}_2\text{H}_6\text{O}$
<i>IUPAC Name</i>	Ethanol	Methoxymethane
<i>Reason for different properties</i>	<i>Difference in their functional groups</i>	

2.

<i>Compound</i>	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$	$\text{CH}_3\text{-O-CH}_2\text{-CH}_3$
<i>Molecular formula</i>	$\text{C}_3\text{H}_8\text{O}$	$\text{C}_3\text{H}_8\text{O}$
<i>IUPAC Name</i>	Propan-1-ol	Methoxyethane
<i>Reason for different properties</i>	<i>Difference in their functional groups</i>	

38. ♥♥♥ Write the IUPAC name of the position isomer and functional isomers of Butan-1-ol

Answer :

Butan -1- ol		
Position isomer	Butan -2- ol	
Functional isomers	Ethoxyethane	Methoxypropane