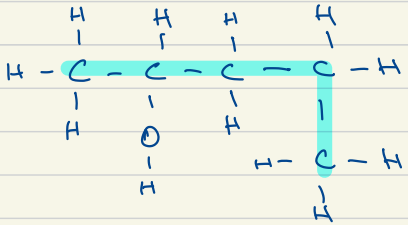


pentan-2-ol

Isomerism

Isomers :- Compounds having the same molecular formulas but different properties.

Types of Isomerism

- Structural Isomerism
- Stereo Isomerism → NOT IN SYLLABUS

Structural Isomerism

→ Existance of compounds having the same Molecular Formula but different structural formulas

→ It is divided into the following

1:- Chain Isomerism
2:- Position Isomerism.
3:- functional Group.

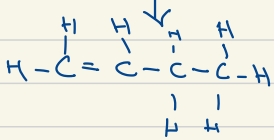
Position Isomerism

No difference in carbon chain or skeleton However, the position of the functional group differs.

ALKANE = No position isomerism b/c it doesn't have a functional group

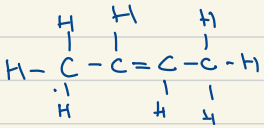
Alkene

C_4H_8



$CH_2=CH \cdot CH_2 \cdot CH_3$

But-1-ene



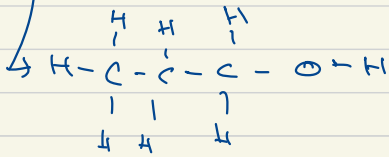
$CH_3 \cdot CH=CH \cdot CH_3$

But-2-ene

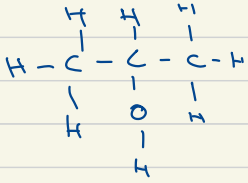
no position isomers. C_2H_4, C_3H_6

Alcohol

C_3H_7OH



propan-1-ol



propan-2-ol

Chain Isomerism

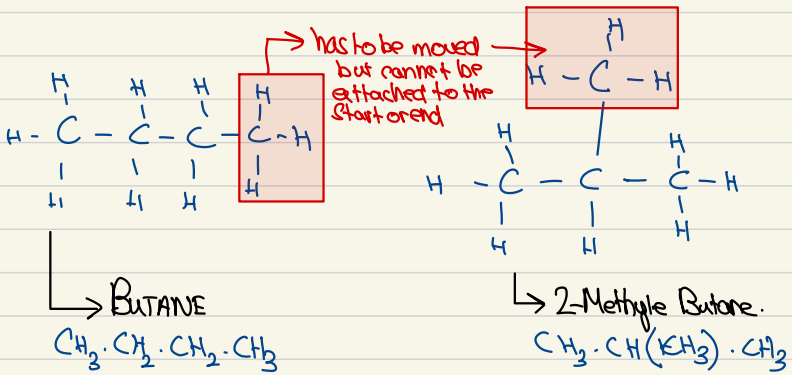
→ In this type of Isomerism the carbon chain differs but the molecular formula stays the same. They also have the same mass, but different displayed and condensed formula hence different structural formula.

Alkanes

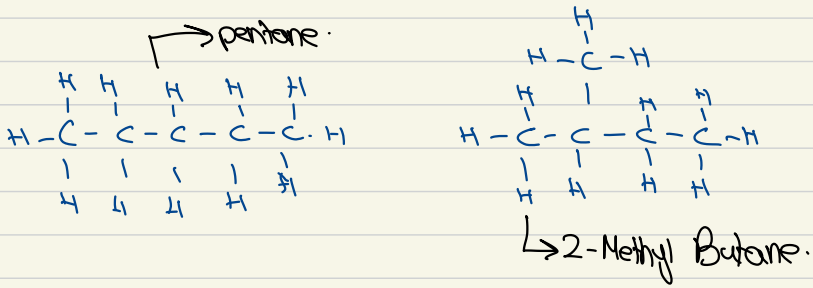
CH_4
C_2H_6
C_3H_8
C_4H_{10}

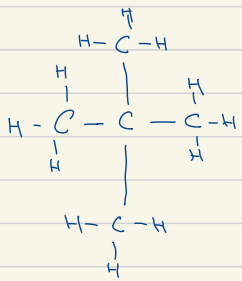
NO CHAIN ISOMERISM POSSIBLE

C_4H_{10} (Butane) TWO CHAIN ISOMERS POSSIBLE



C_5H_{12} (pentane) 3 CHAIN ISOMERS



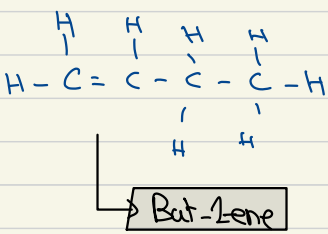


⇒ 2-dimethyle propane

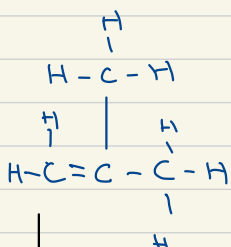
Alkene

C_2H_4
C_3H_6
] NO CHAIN ISOMERISM

C_4H_8 (butene)



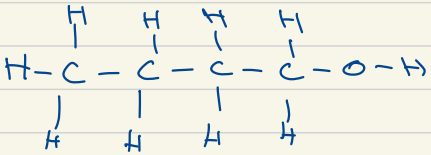
But-1-ene



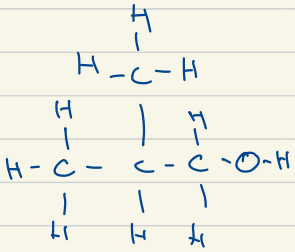
2-Methyle Prop.-1-ene

Alcohol

C_4H_9OH



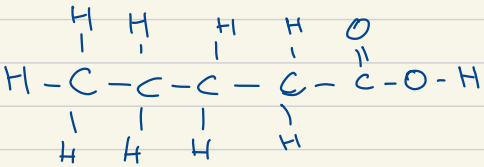
Butan 1-ol



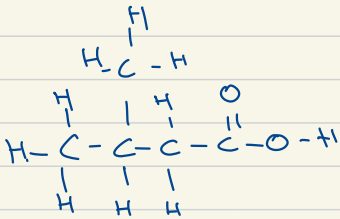
2-Methyle Propan-1-ol

Carboxylic Acid

C_4H_9COOH



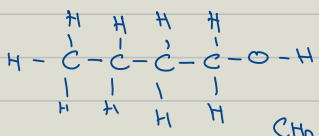
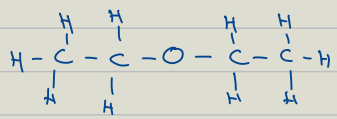
pentanoic acid



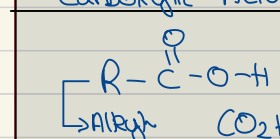
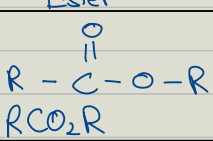
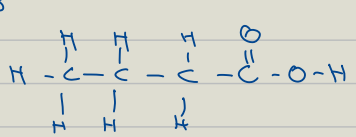
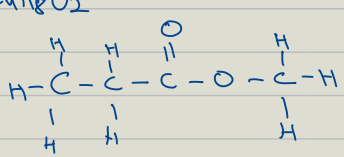
Functional Group Isomerism

Compounds having the same molecular formula but different functional groups and therefore different chemical properties.

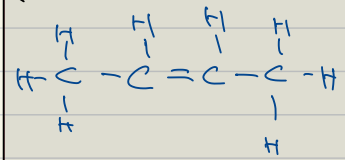
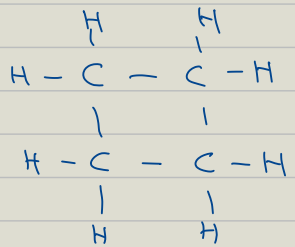
1) Alcohol and ether are isomeric.

	ALCOHOL	ETHER
functional group	R —O—H Alkyl ← ROH (carbon atoms)	R - O - R
general formula (Alkane)O n = 4	$C_n H_{2n+1} OH$ (But for better understanding we will use) $C_n H_{2n+2} O$	Because they are isomers they have the same molecular and general formula $C_n H_{2n+2} O$
	$C_4 H_{10} O$ → Butan-1-ol  $CH_3 \cdot CH_2 \cdot CH_2 CH_2 OH$	$C_4 H_{10} O$  $CH_3 \cdot CH_2 \cdot O \cdot CH_2 \cdot CH_3$

2)

	Carboxylic Acid	Ester
functional group	 Alkyl CO_2H	 RCO_2R
General Formula (Alkane)O_2 n = 4	$C_n H_{2n+2} COOH$ (But for better understanding) $C_n H_{2n} O_2$	Because they are isomers they have the same molecular and general formula. $C_n H_{2n} O_2$
	$C_4 H_8 O_2$ 	$C_4 H_8 O_2$ 

3)

	ALKENE	CYCLO ALKANE
functional group	$C=C$	—
general formula	C_nH_{2n}	Because Isomers they have same general formula C_nH_{2n}
n=4	 C_4H_8 But-2-ene	 cyclo butane

Similarities between Isomers

1. Same molecular formula
2. Same emperical formula
3. Same molecular mass
4. Same percentage composition
5. Similar chemical properties only if it is chain and position isomerism.

Differences b/w isomers

1. Different M.P and B.P
2. " " displayed formula
3. " " condensed formula
4. " " densities
5. " " solubilities
5) " " solubilities in organic solvent
6) " " Chemical properties only if they are functional group Isomers.
7) Different strength of intermolecular forces.

Isomerism

The compounds having the same molecular formula but different propperties.

Types of Isomerism

1) Structural Isomerism
2) Stereo Isomerisation (not in syllabus)

Structural Isomerism:

Existence of compounds having the same molecular formula but different structure

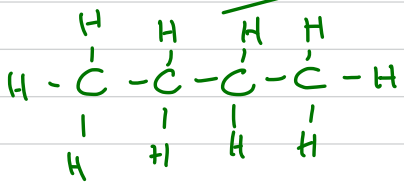
It is divided into the following:

1) Chain Isomerism
2) Position Isomerism
3) Functional group Isomerism

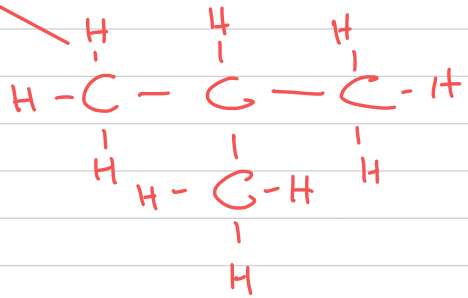
Chain Isomerism

↳ In this type of Isomerism, the Carbon chain differs but the molecular formula stays the same

Butane C_4H_{10}



Butane



2 methyl Propane

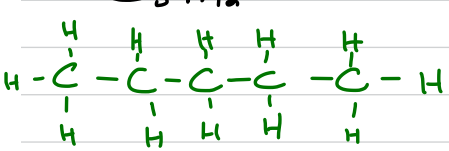
$CH_3CH_2 \cdot CH_2 \cdot CH_3$

$CH_3 \cdot CH(CH_3) \cdot CH_3$

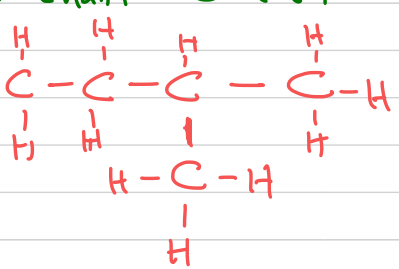
Why are they Isomers?

- Same Molecular formula
- Same molecular mass
- Different displayed formula
- Different condensed formula
- Different Structural formula

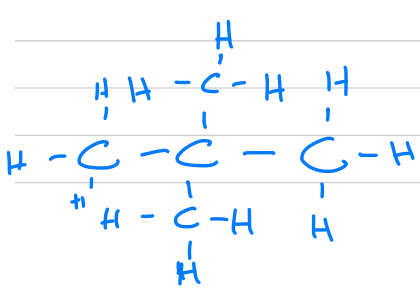
C_5H_{12} – Pentane (3 chain isomers)



Pentane



2 methyl Butane

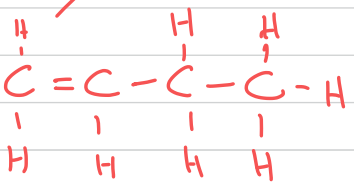


2-d: Methyl Propane

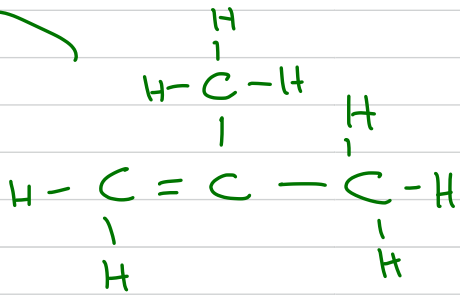
Alkene

Minimum number of Carbons for Chain Isomers: 4

C_4H_8



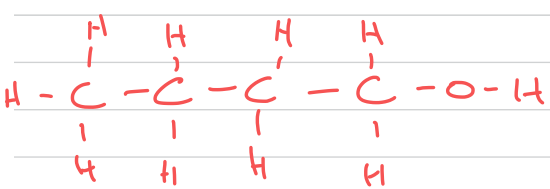
But-1-ene

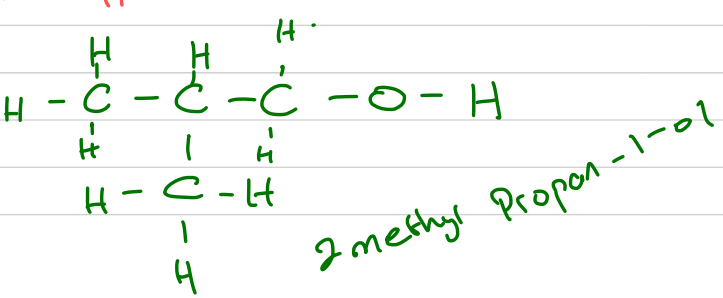


2 Methyl Prop-1-ene

Alcohol

Chain Isomers : C_4 Onwards

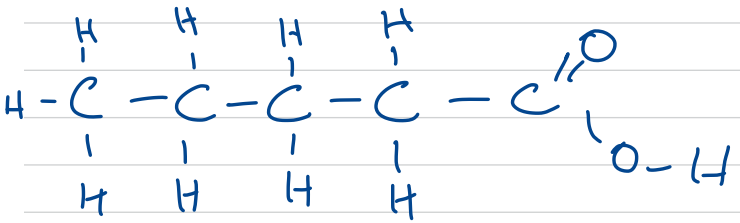


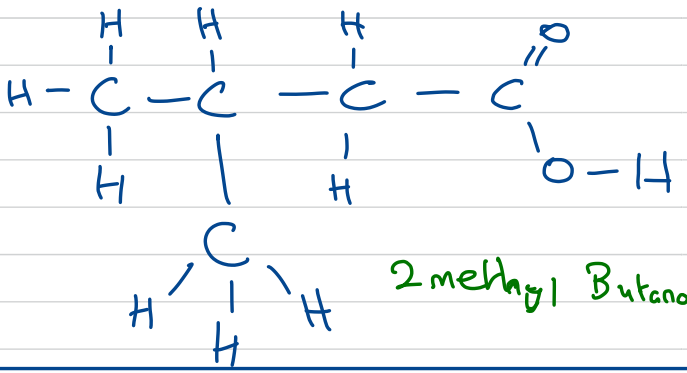


2 methyl Propan-1-ol

Carboxylic Acid

C_4H_9COOH



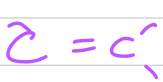


2 methyl Butanoic Acid

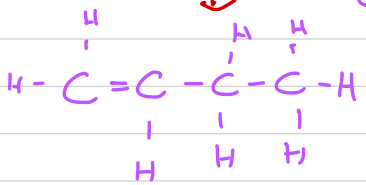
Position Isomerisation naming is crucial

- No difference is Carbon chain or skeleton, position of functional group differs.

Alkane: no position Isomerism as it doesn't have a functional group

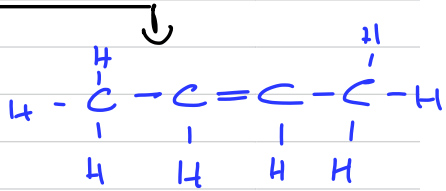
Alkene: 

C_4H_8



But-1-ene

$CH_2 = CH \cdot CH_2 \cdot CH_3$

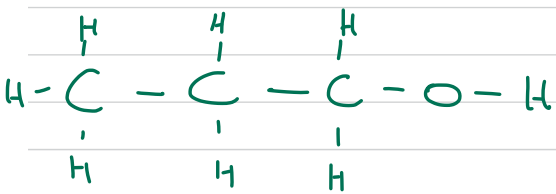


But-2-ene

$CH_3 \cdot CH = CH \cdot CH_3$

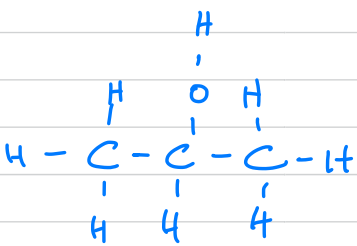
Alcohol

C_3H_7OH



Propan-1-ol

$CH3 \cdot CH_2 \cdot CH_2 \cdot OH$



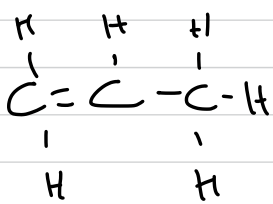
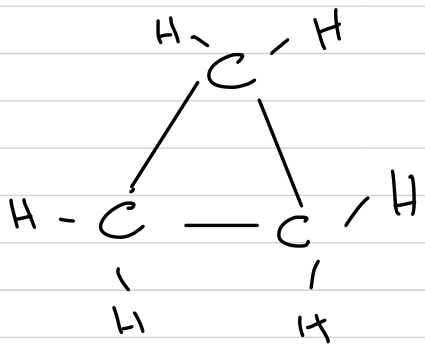
Propan-2-ol

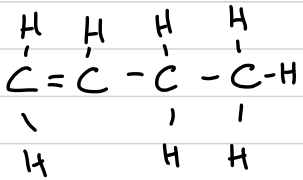
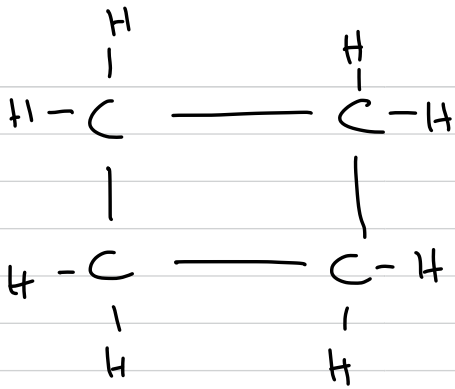
$CH_3 \cdot CH(OH) \cdot CH_3$

Functional Group Isomerism

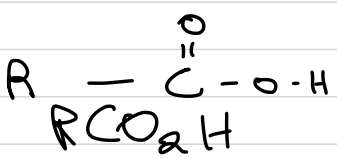
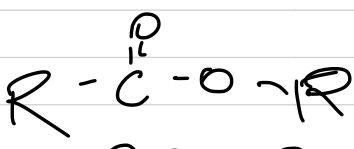
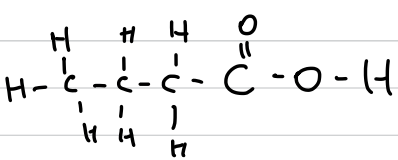
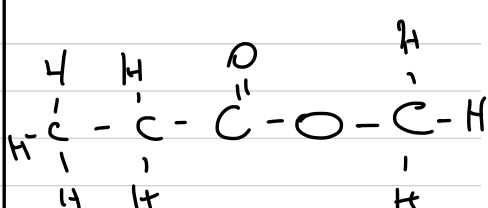
Compounds having the same molecular formula but different functional groups and therefor different physical properties and chemical properties.

1) Alkene and Cyclo-Alkane are isomeric

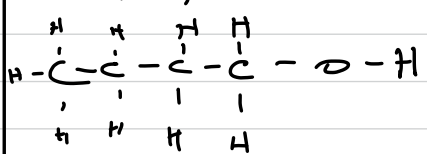
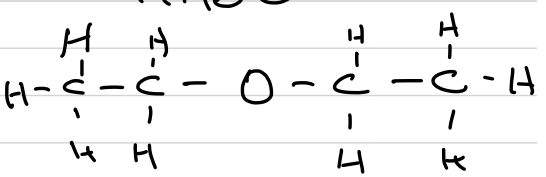
	Alkenes	Cycloalkane
	C_nH_{2n}	C_nH_{2n}
$n=3$	C_3H_6 	C_3H_6 Cyclopropane  no C=C Thus is saturated. ↓ Hence undergoes Substitution

$n = 4$		 Cyclobutane

2) Carboxylic Acid and esters are isomeric

	Carboxylic Acid	Esters
	$C_nH_{2n}O_2$ ↳ Also used	$C_nH_{2n}O_2$
functional group	 RCO_2H	 RCO_2R
$n = 4$	$C_4H_8O_2$	$C_4H_8O_2$
		

3) Alcohol and Ether are isomeric

	Alcohol	Ether
	$C_nH_{2n+2}O$	$C_nH_{2n+2}O$
Functional group	$R-O-H$	$R-O-R$
$n=4$	$C_4H_{10}O$ 	$C_4H_{10}O$ 

Similarities between Isomers

- Same molecular formula
- Same molecular mass
- Same percentage composition
- Similar chemical properties only if it is chain or position isomerism.

Difference between Isomers.

- Different M.P and B.P
- Different displayed formula

- Different Structural formula
  Different condensed formula.
- Different Densities
- Different Sollubilities in organic Solvent
- Different Chemical properties only if they are functional group isomers
  - Different streagth of intermollecular forces.

→ Alkane Series

It's a homologous series of saturated hydrocarbons having a general formula C_nH_{2n+2}.

Type of Hydrocarbon: Saturated
Elements present: Carbon and Hydrogen only

Sources:

1) Natural gas: It contains mostly methane with small quantities of ethane, propane and butane

2) Crude Oil or Petroleum: Naturally occuring and Chief source of every alkane.