

## Isomerism

It is possible for organic molecules with the same molecular formula to have different structures

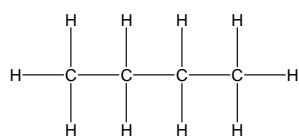
**Definition- Structural isomers:** same molecular formula different structures (or structural formulae)

There are three types of structural isomerism

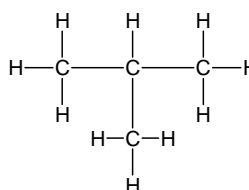
- Chain isomerism
- Position isomerism
- Functional group isomerism

**Chain isomerism:** Compounds with the same molecular formula but different structures of the carbon skeleton

These isomers arise because the carbon chains can be branched. For example, there are two isomers of butane,  $C_4H_{10}$ . In one of them, the carbon atoms lie in a "straight chain" whereas in the other the chain is branched

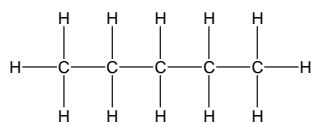


butane

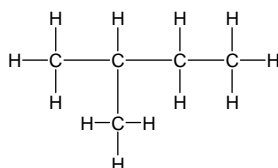


methyl propane

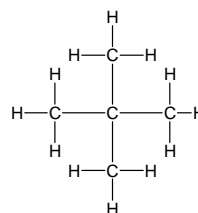
There are three isomers of pentane  $C_5H_{12}$



pentane



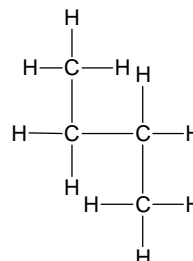
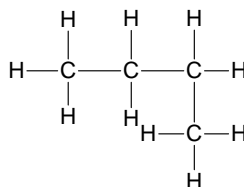
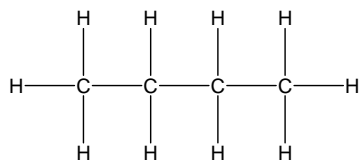
2-methylbutane



2,2-dimethylpropane

### False isomers

Do not draw "false" isomers which are just twisted versions of the original molecule. Twisting the molecule into a different shape does not make a different isomer. Isomers are only formed if a bond would have to be broken and reassembled into the different structure

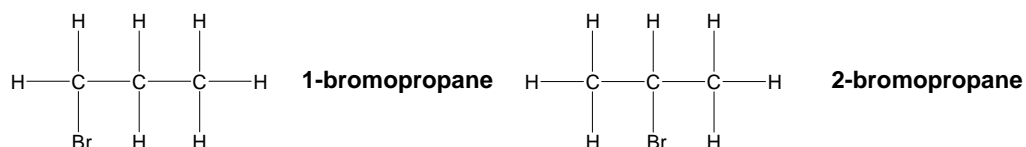


These are all exactly the same compound.

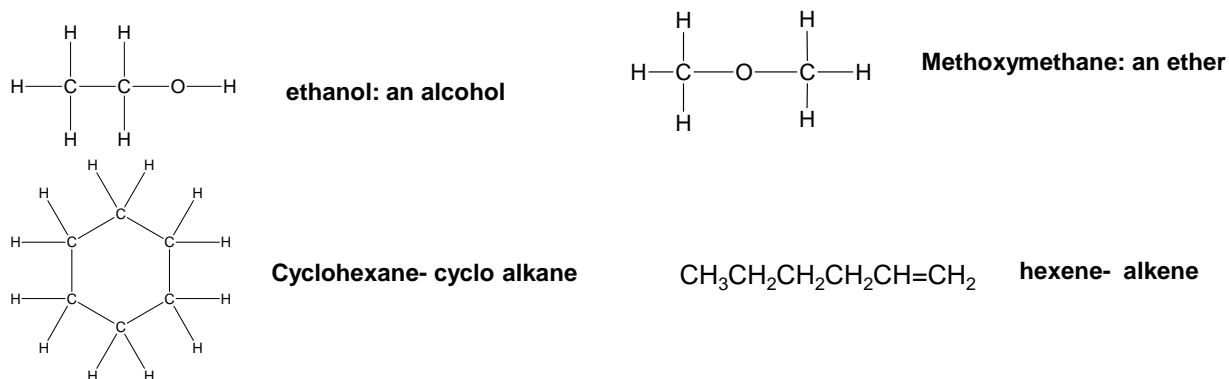
## Number of Possible Chain Isomers for Selected Alkanes

Molecular Formula	Number of possible isomers
$C_4H_{10}$	2
$C_5H_{12}$	3
$C_6H_{14}$	5
$C_7H_{16}$	9
$C_8H_{18}$	18
$C_9H_{20}$	35
$C_{10}H_{22}$	75
$C_{15}H_{32}$	4,347
$C_{20}H_{42}$	336,319
$C_{30}H_{62}$	4,111,846,763

**Position isomers:** Compounds with the same molecular formula but different structures due to different positions of the same functional group on the same carbon skeleton



**Functional group isomers:** Compounds with the same molecular formula but with atoms arranged to give different functional groups



Aldehydes and ketones of the same chain length would be classed as functional group isomers- e.g. Propanal and propanone (both  $C_3H_6O$ )

