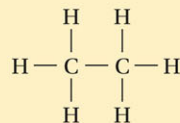
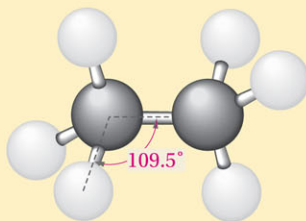


Chapter 2 : Alkanes and Cycloalkanes

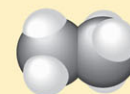


The Structure of Alkanes

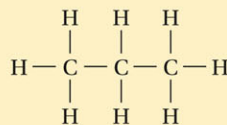
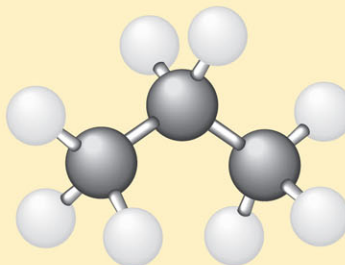
ethane



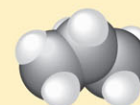
or



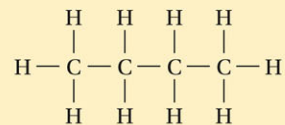
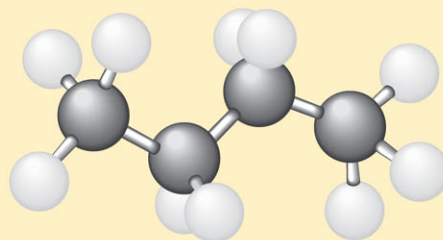
propane



or



butane



or

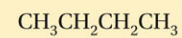
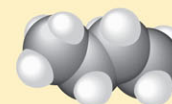
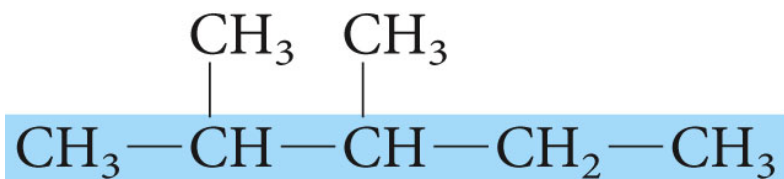


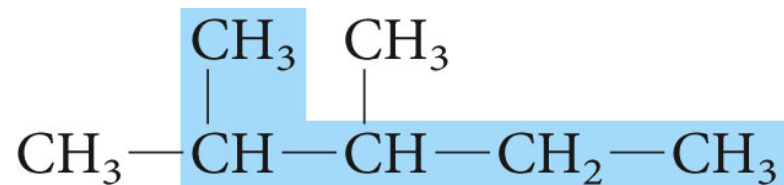
Table 2.1  **Names and Formulas of the First Ten Unbranched Alkanes**

Name	Number of carbons	Molecular formula	Structural formula	Number of structural isomers
methane	1	CH ₄	CH ₄	1
ethane	2	C ₂ H ₆	CH ₃ CH ₃	1
propane	3	C ₃ H ₈	CH ₃ CH ₂ CH ₃	1
butane	4	C ₄ H ₁₀	CH ₃ CH ₂ CH ₂ CH ₃	2
pentane	5	C ₅ H ₁₂	CH ₃ (CH ₂) ₃ CH ₃	3
hexane	6	C ₆ H ₁₄	CH ₃ (CH ₂) ₄ CH ₃	5
heptane	7	C ₇ H ₁₆	CH ₃ (CH ₂) ₅ CH ₃	9
octane	8	C ₈ H ₁₈	CH ₃ (CH ₂) ₆ CH ₃	18
nonane	9	C ₉ H ₂₀	CH ₃ (CH ₂) ₇ CH ₃	35
decane	10	C ₁₀ H ₂₂	CH ₃ (CH ₂) ₈ CH ₃	75

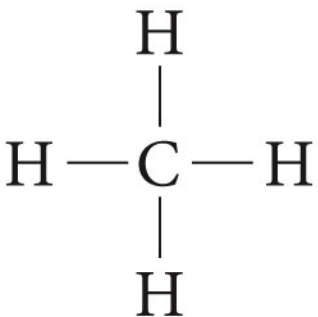
Nomenclature of Organic Compounds



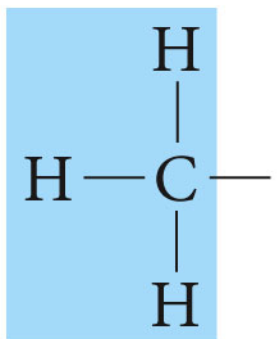
or



Alkyl groups



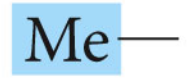
methane



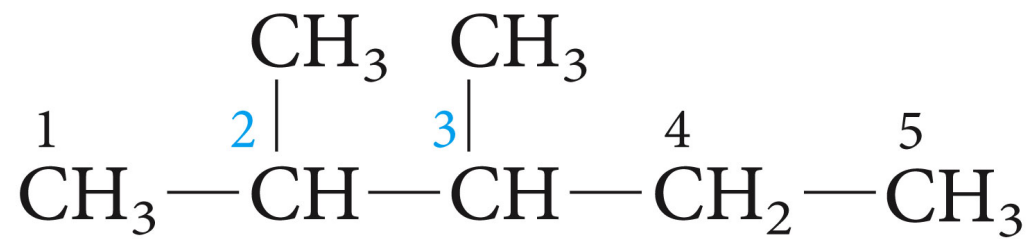
or



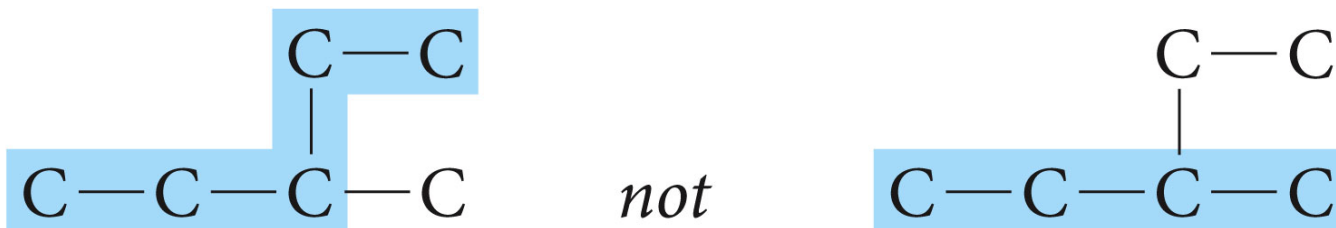
or



methyl group



Numbering the parent carbon chain



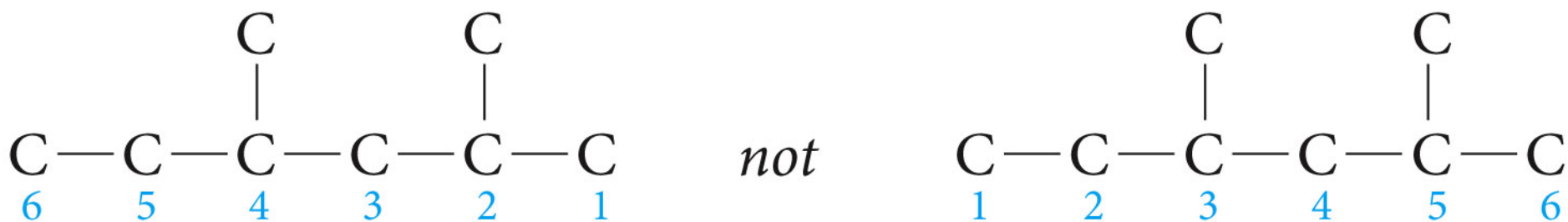
The root name is that of the longest continuous carbon chain (*parent carbon chain*)

Groups attached to the main chain are called **substituents**. Saturated substituents that contain only carbon and hydrogen are called **alkyl groups**. Named by replacing the *-ane* of the alkane by *-yl*

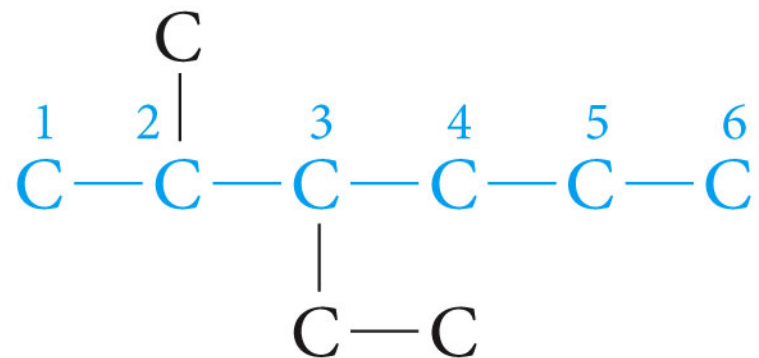
The main chain is numbered such that the first substituent encountered along the chain receives the lowest possible number.

Each substituent is then located by the number of the carbon to which it is attached.

When two or more identical groups are attached to the main chain, prefixes such as *di-*, *tri-*, *tetra-*, are used.

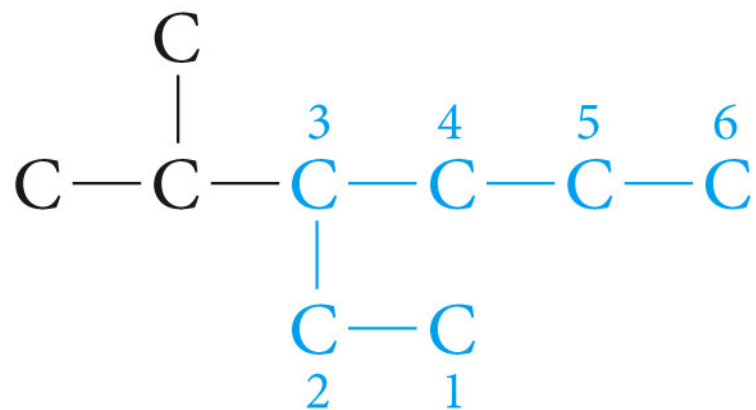


If there are two equally long continuous chains, select the one with the most branches.



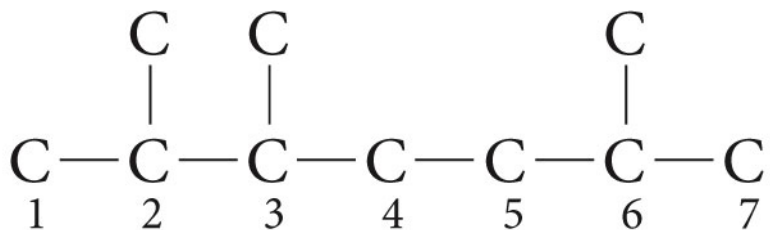
two branches

not



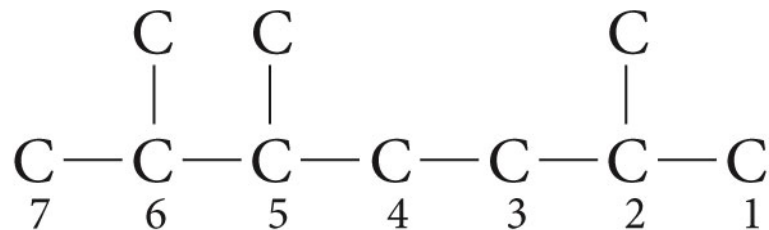
one branch

If there is a branch equidistant from each end of the longest chain, begin numbering nearest to a third branch.



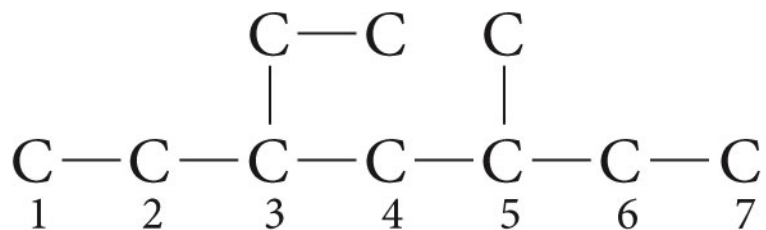
2,3,6-trimethylheptane

not



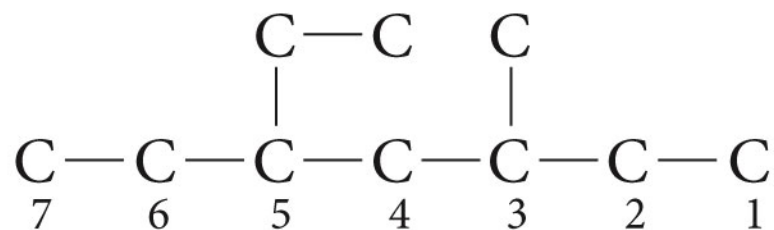
2,5,6-trimethylheptane

If there is no third branch, begin numbering nearest the substituent whose name has alphabetic priority;



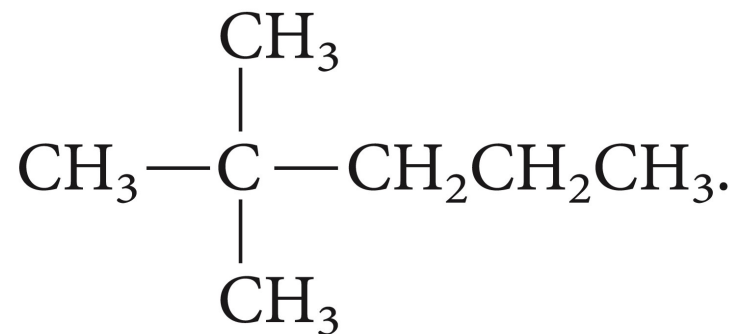
3-ethyl-5-methylheptane

not

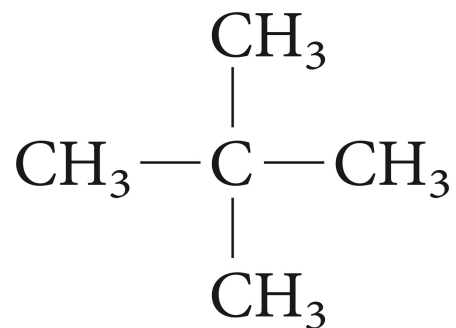
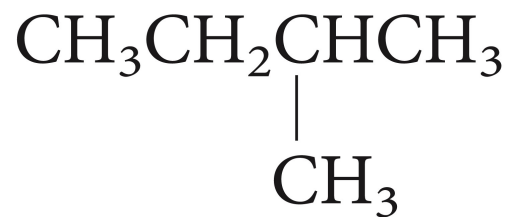
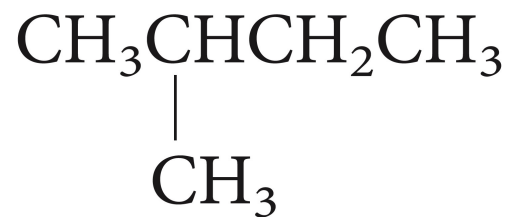


5-ethyl-3-methylheptane

Give the IUPAC name for the compound shown?



Give the IUPAC name of the following compounds:



Alkyl and Halogen Substituents



ethane



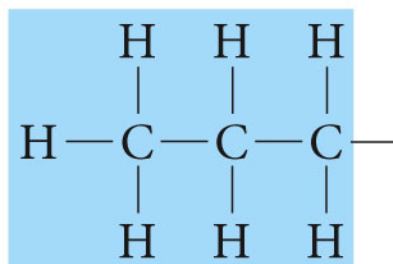
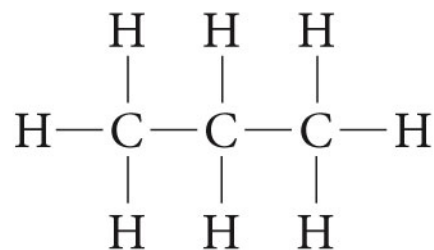
or



or



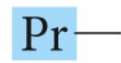
ethyl group



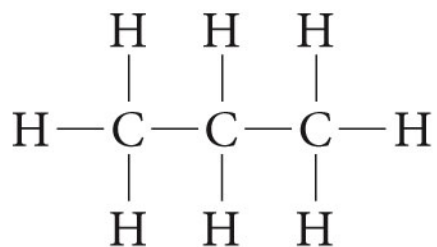
or



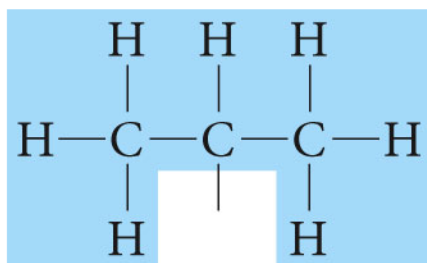
or



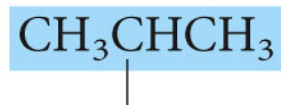
propyl group



propane



or



or



isopropyl or 1-methylethyl* group

There are four different butyl groups



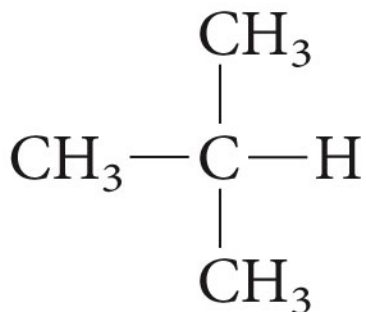
butyl

and

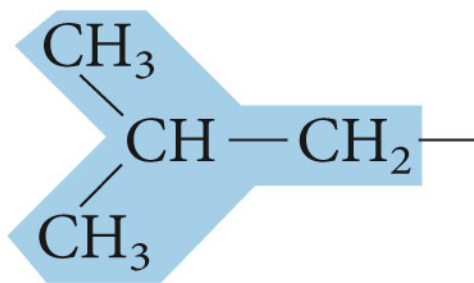


sec-butyl

(or 1-methylpropyl)



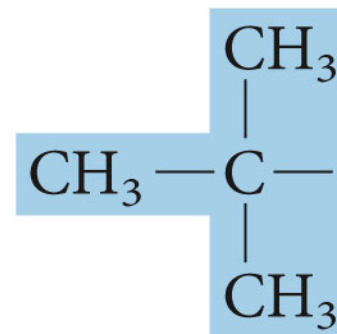
isobutane



isobutyl

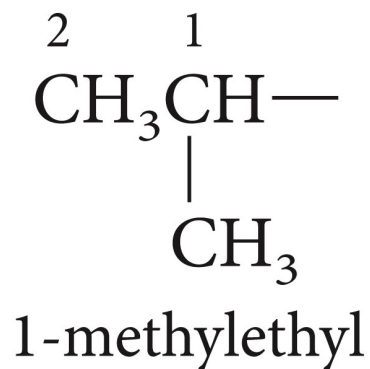
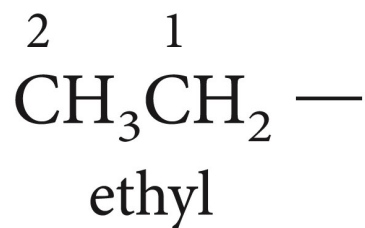
(or 2-methylpropyl)

and



tert-butyl

(or 1,1-dimethylethyl)



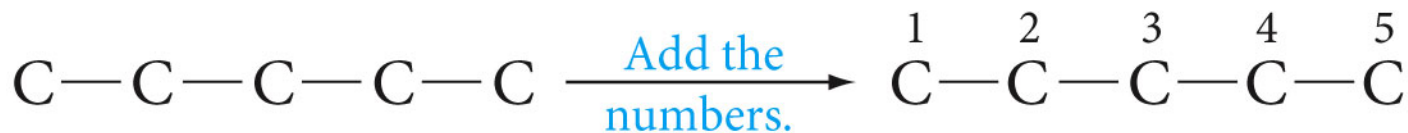
The letter R is used as a general symbol for an alkyl group.

R-H alkane

R-X X=F, Cl, Br, I (halogen) Alkyl halide

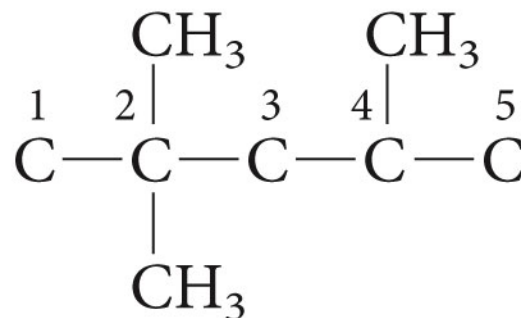
Named: F- (fluoro-), Cl- (chloro-), Br- (bromo-) I- (iodo-)

Write the formula for 2,2,4-trimethylpentane

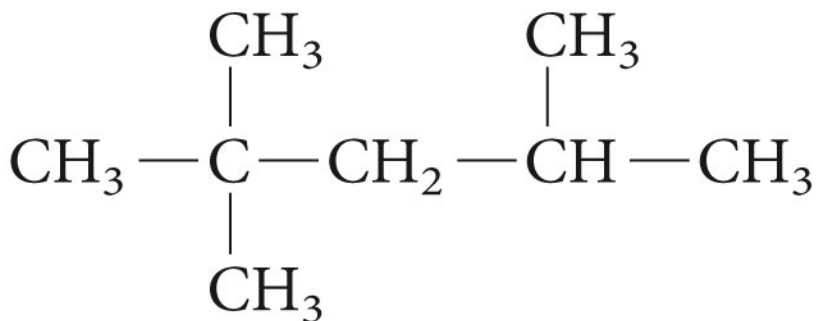


Write down the
pentane chain.

Add the three
methyl substituents.

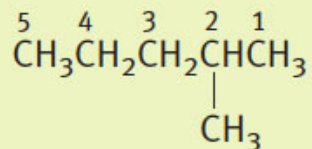


Fill in the
hydrogens.

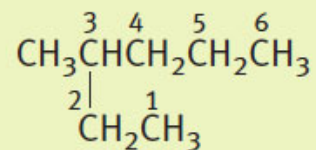


2,2,4-trimethylpentane

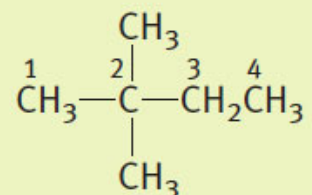
Table 2.2 Examples of Use of the IUPAC Rules



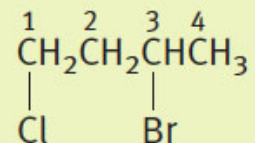
2-methylpentane
(not 4-methylpentane)



3-methylhexane
(not 2-ethylpentane
or 4-methylhexane)



2,2-dimethylbutane
(not 2,2-methylbutane
or 2-dimethylbutane)



3-bromo-1-chlorobutane
(not 1-chloro-3-bromobutane
or 2-bromo-4-chlorobutane)

The ending *-ane* tells us that all the carbon-carbon bonds are single; *pent-* indicates five carbons in the longest chain. We number them from right to left, starting closest to the branch point.

This is a six-carbon saturated chain with a methyl group on the third carbon. We would usually write the structure as $\text{CH}_3\text{CH}_2\text{CHCH}_2\text{CH}_2\text{CH}_3$.



There must be a number for each substituent, and the prefix *di-* says that there are two methyl substituents.

First, we number the butane chain from the end closest to the first substituent. Then we name the substituents in alphabetical order, regardless of position number.

Name the following compounds by the IUPAC system:



Write the structure for 3,3-dimethyloctane