2.8
IUPAC Nomenclature of Unbranched Alkanes

Table 2.4
IUPAC Names of Unbranched Alkanes

Retained:

methane	CH_4
ethane	CH_3CH_3
propane	$CH_3CH_2CH_3$
butane	$CH_3CH_2CH_2CH_3$

Table 2.4
IUPAC Names of Unbranched Alkanes

Note:

n-prefix is not part of IUPAC name of any alkane.

For example: *n*-butane is "common name" for $CH_3CH_2CH_2CH_3$; butane is "IUPAC name."

Others:

Latin or Greek prefix for number of carbons + ane suffix

Table 2.4
IUPAC Names of Unbranched Alkanes

Number of carbons	Name	Structure
5	pentane	$CH_3(CH_2)_3CH_3$
6	hexane	$CH_3(CH_2)_4CH_3$
7	heptane	$CH_3(CH_2)_5CH_3$
8	octane	$CH_3(CH_2)_6CH_3$
9	nonane	$CH_3(CH_2)_7CH_3$
10	decane	$CH_3(CH_2)_8CH_3$

Table 2.4
IUPAC Names of Unbranched Alkanes

Number of carbons	Name	Structure
11	undecane	$CH_3(CH_2)_9CH_3$
12	dodecane	$CH_3(CH_2)_{10}CH_3$
13	tridecane	$CH_3(CH_2)_{11}CH_3$
14	tetradecane	$CH_3(CH_2)_{12}CH_3$
15	pentadecane	$CH_3(CH_2)_7CH_3$
16	hexadecane	$CH_3(CH_2)_8CH_3$

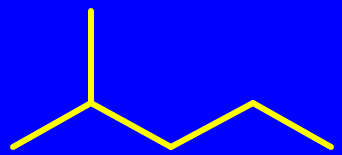
Table 2.4
IUPAC Names of Unbranched Alkanes

Number of carbons	Name	Structure
17	heptadecane	$CH_3(CH_2)_{15}CH_3$
18	octadecane	$CH_3(CH_2)_{16}CH_3$
19	nonadecane	$CH_3(CH_2)_{17}CH_3$
20	icosane	$CH_3(CH_2)_{18}CH_3$
25	pentacosane	$CH_3(CH_2)_{22}CH_3$
30	triacontane	$CH_3(CH_2)_{28}CH_3$

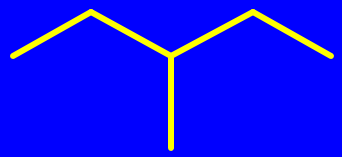
2.9
Applying the IUPAC Rules: The Names of the C_6H_{14} Isomers

The C_6H_{14} Isomers

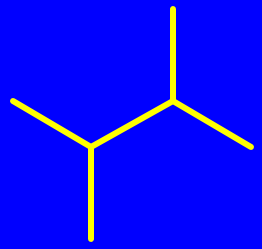
$CH_3CH_2CH_2CH_2CH_2CH_3$



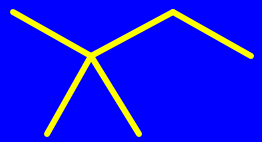
$(CH_3)_2CHCH_2CH_2CH_3$



$(CH_3CH_2)_2CHCH_3$



$(CH_3)_2CHCH(CH_3)_2$



$(CH_3)_3CCH_2CH_3$

The C_6H_{14} Isomers

$CH_3CH_2CH_2CH_2CH_2CH_3$

Hexane

The IUPAC name of the unbranched alkane with a chain of 6 carbons is hexane.

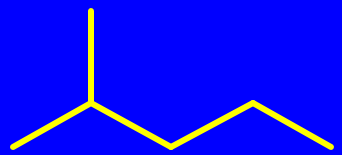
IUPAC Nomenclature of Branched Alkanes (Table 2.7)

Step 1) Find the longest continuous carbon chain and use the IUPAC name of the unbranched alkane as the basis.

Step 2) Add name of substituent as a prefix.

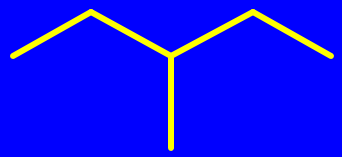
Step 3) Number the chain from the end nearest the substituent, and identify the carbon to which the substituent is attached by number.

The C_6H_{14} Isomers



$(CH_3)_2CHCH_2CH_2CH_3$

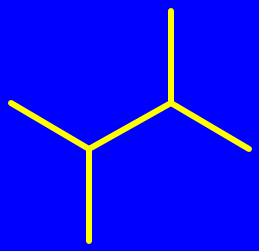
2-Methylpentane



$(CH_3CH_2)_2CHCH_3$

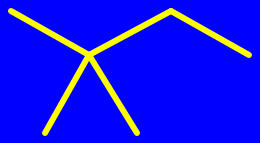
3-Methylpentane

The C_6H_{14} Isomers



$(CH_3)_2CHCH(CH_3)_2$

2,3-Dimethylbutane



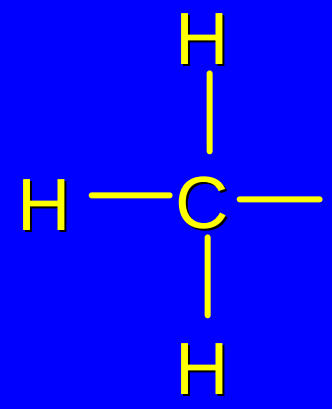
$(CH_3)_3CCH_2CH_3$

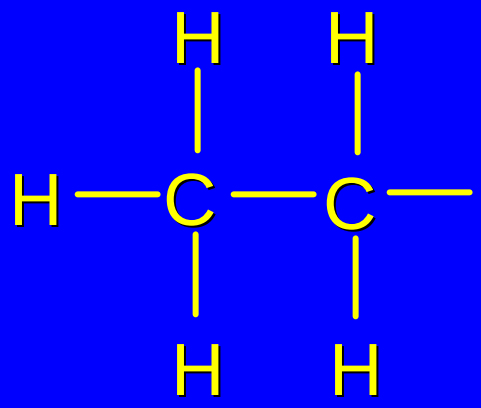
2,2-Dimethylbutane

Use replicating prefixes (di-, tri-, tetra-, etc.) according to the number of identical substituents attached to the main chain.

2.10
Alkyl Groups

Methyl and Ethyl Groups

Methyl  or CH_3-

Ethyl  or CH_3CH_2-

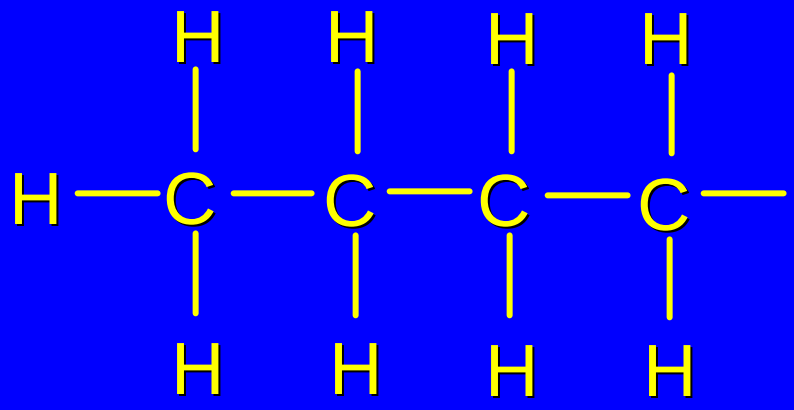
Unbranched Alkyl Groups

If potential point of attachment is at the end of the chain, take the IUPAC name of the corresponding unbranched alkane and replace the -*ane* ending by -*yl*.

Unbranched Alkyl Groups

R—H R—

If potential point of attachment is at the end of the chain, take the IUPAC name of the corresponding unbranched alkane and replace the *-ane* ending by *-yl*.



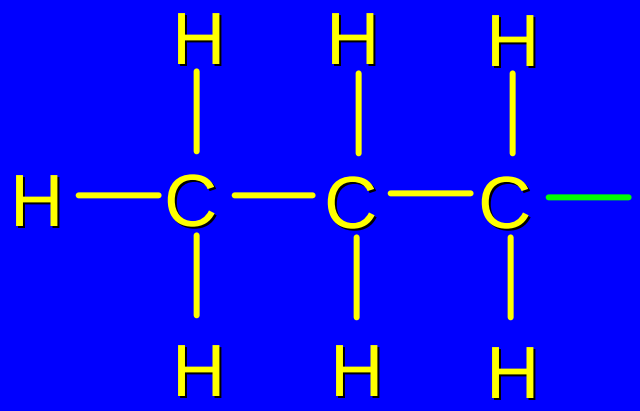
or $CH_3CH_2CH_2CH_2$—

Butyl

Unbranched Alkyl Groups

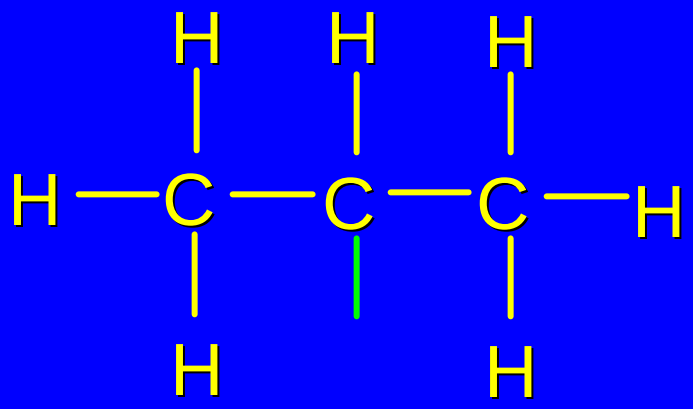
$CH_3(CH_2)_4CH_2-$	Hexyl
$CH_3(CH_2)_5CH_2-$	Heptyl
$CH_3(CH_2)_{16}CH_2-$	Octadecyl

The C_3H_7 Alkyl Groups



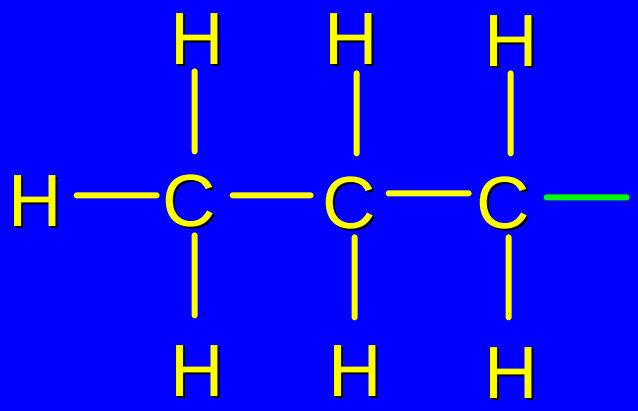
or $CH_3CH_2CH_2-$

and



or CH_3CHCH_3

The C_3H_7 Alkyl Groups



or

$CH_3CH_2CH_2-$

IUPAC name: Propyl

Common name: *n*-Propyl

Naming Alkyl Groups (Table 2.8)

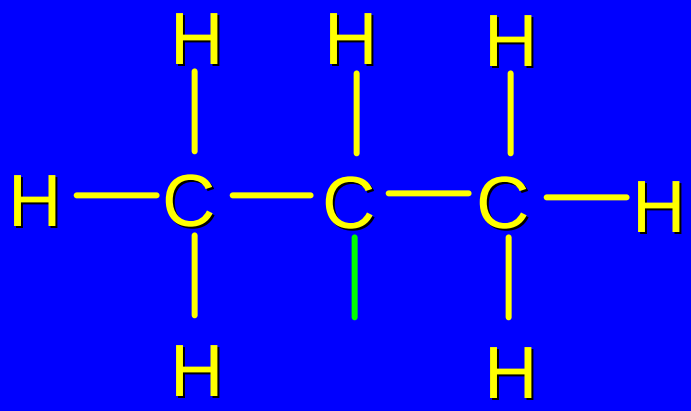
Step 1: Identify longest continuous chain starting at point of attachment.

Step 2: Drop -*ane* ending from name of unbranched alkane having same number of carbons as longest continuous chain and replace by -*yl*.

Step 3: Identify substituents on longest continuous chain.

Step 4: Chain is always numbered starting at point of attachment.

The C_3H_7 Alkyl Groups



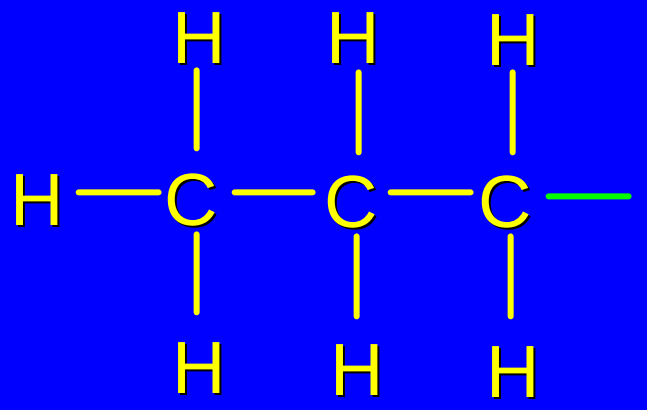
or

CH_3CHCH_3

IUPAC name: 1-Methylethyl

Common name: Isopropyl

The C_3H_7 Alkyl Groups



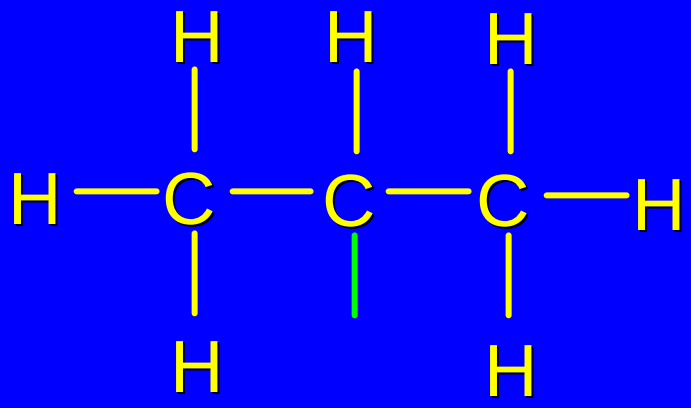
or

$CH_3CH_2CH_2-$

Classification: Primary alkyl group

Alkyl groups are classified according to the degree of substitution at the carbon that bears the point of attachment. A carbon that is directly attached to one other carbon is a primary carbon.

The C_3H_7 Alkyl Groups



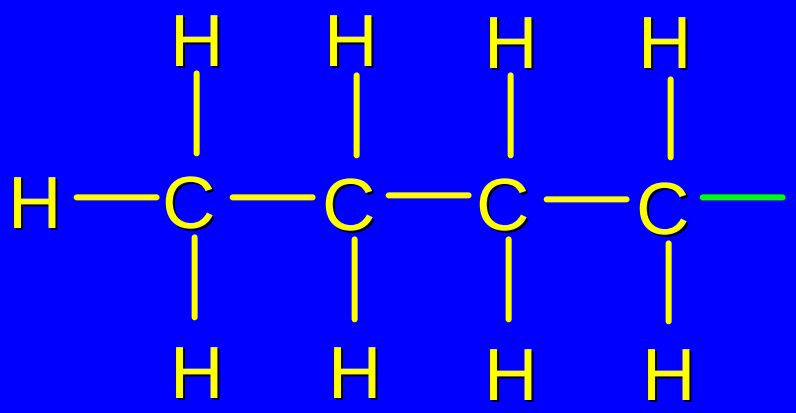
or

CH_3CHCH_3

Classification: Secondary alkyl group

Alkyl groups are classified according to the degree of substitution at the carbon that bears the point of attachment. A carbon that is directly attached to two other carbons is a secondary carbon.

The C_4H_9 Alkyl Groups



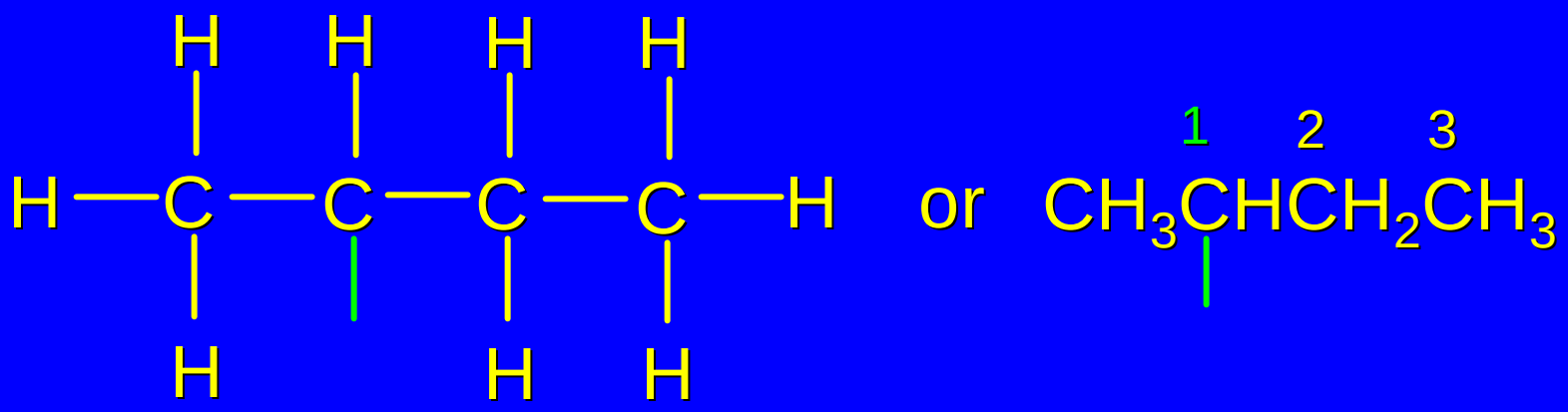
or $CH_3CH_2CH_2CH_2-$

IUPAC name: Butyl

Common name: *n*-Butyl

Classification: Primary alkyl group

The C_4H_9 Alkyl Groups

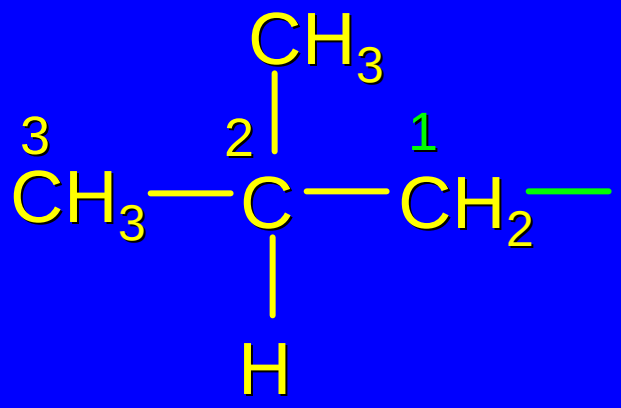


IUPAC name: 1-Methylpropyl

Common name: *sec*-Butyl

Classification: Secondary alkyl group

The C_4H_9 Alkyl Groups

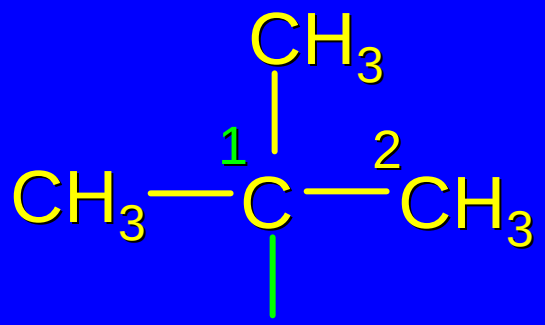


IUPAC name: 2-Methylpropyl

Common name: Isobutyl

Classification: Primary alkyl group

The C_4H_9 Alkyl Groups



IUPAC name: 1,1-Dimethylethyl

Common name: *tert*-Butyl

Classification: Tertiary alkyl group

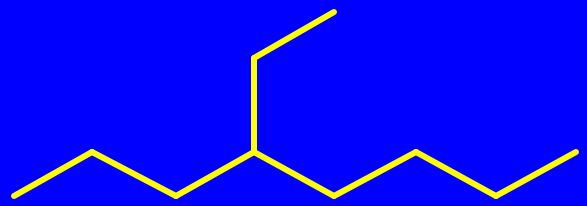
2.11

IUPAC Names of Highly Branched Alkanes

Branched alkanes

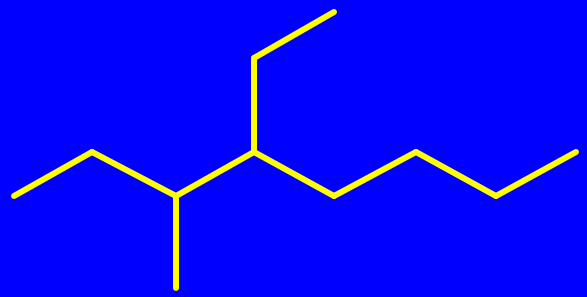
Octane

Branched alkanes



4-Ethyloctane

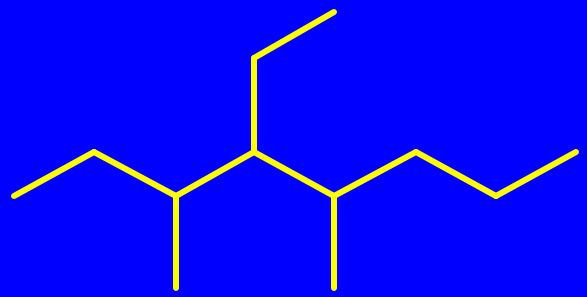
Branched alkanes



4-Ethyl-3-methyloctane

List substituents in alphabetical order.

Branched alkanes

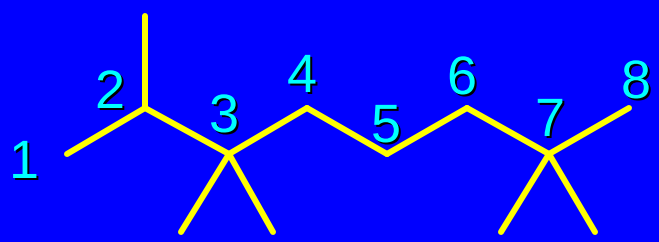


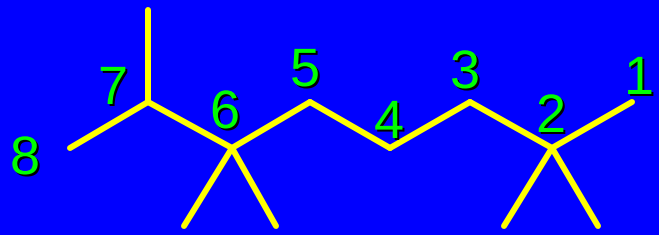
4-Ethyl-3,5-dimethyloctane

List substituents in alphabetical order.

But don't alphabetize di-, tri-, tetra-, etc.

First Point of Difference Rule





What is correct name?

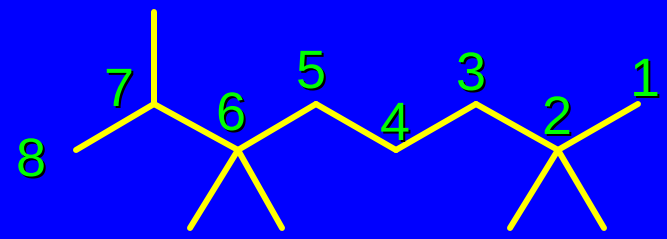
2,3,3,7,7-Pentamethyloctane?

2,2,6,6,7-Pentamethyloctane?

The chain is numbered in the direction that gives the lower locant to the substituent at the first point of difference in the names.

Don't add locants!

First Point of Difference Rule



What is correct name?

2,2,6,6,7-Pentamethyloctane?

The chain is numbered in the direction that gives the lower locant to the substituent at the first point of difference in the names.

Don't add locants!

C_nH_{2n}

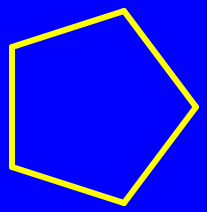
2.12

Cycloalkane Nomenclature

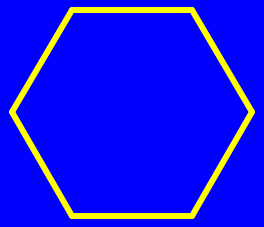
Cycloalkanes

Cycloalkanes are alkanes that contain a ring of three or more carbons.

Count the number of carbons in the ring, and add the prefix *cyclo* to the IUPAC name of the unbranched alkane that has that number of carbons.



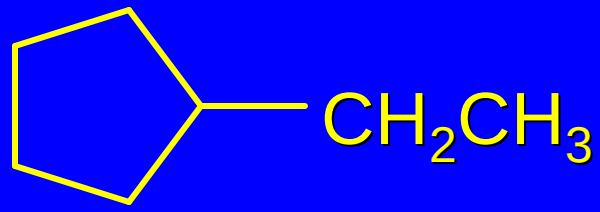
Cyclopentane



Cyclohexane

Cycloalkanes

Name any alkyl groups on the ring in the usual way.

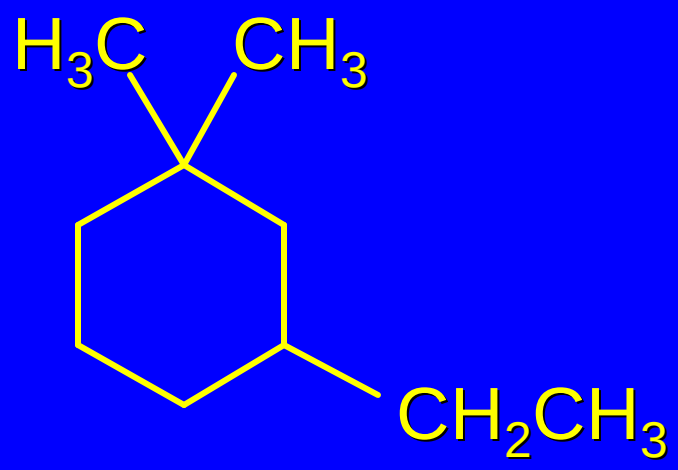


Ethylcyclopentane

Cycloalkanes

Name any alkyl groups on the ring in the usual way.

List substituents in alphabetical order and count in the direction that gives the lowest numerical locant at the first point of difference.



3-Ethyl-1,1-dimethylcyclohexane