

Organic Chemistry 17.1

Introduction to Organic Compounds

Naming Alkanes

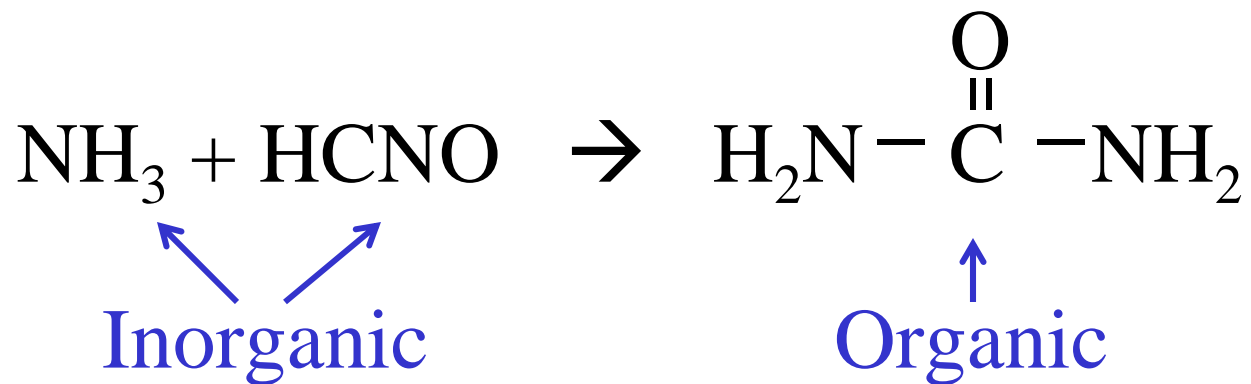
Isomers of Alkanes

Naming Cycloalkanes

What are Organic Compounds?

(1807) The term *organic compound* originated
– Meant compounds derived from living organisms

(1828) Urea, an organic compound, was synthesized:



Urea, a component in
animal urine

What are Organic Compounds?

(Today) **Organic Compounds** are compounds that contain the element carbon.

Except for the following:

Carbonates, CO₂, CO, diamond, and graphite.

What are Organic Compounds?

Rubber

Latex

Silk

Nylon

Methane Gas and Motor Oil

Plastic

Drugs

Most Compounds are Organic

Of the ~20 million compounds that are known today, about 90% are organic!

Why?

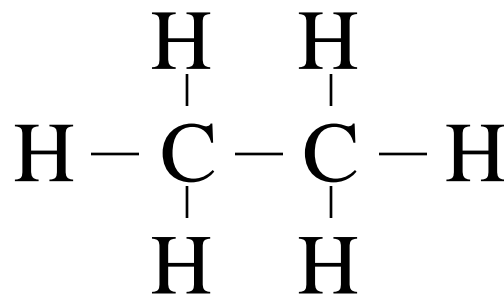
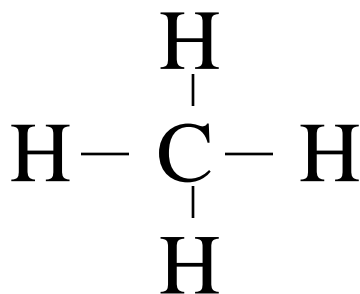
- Carbon bonds to itself in different ways.
 - Forms long chains
 - Forms rings
- Carbon bonds with many other elements.
 - Especially - H, O, N, S, and halogens.

Hydrocarbons

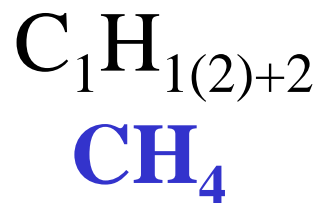
Contain only C and H

- 1) Alkanes (saturated)
- 2) Alkenes (unsaturated)
- 3) Alkynes (unsaturated)
- 4) Aromatic Hydrocarbons (unsaturated)

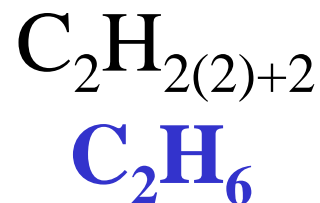
Alkanes



Methane



Ethane



Naming Alkanes

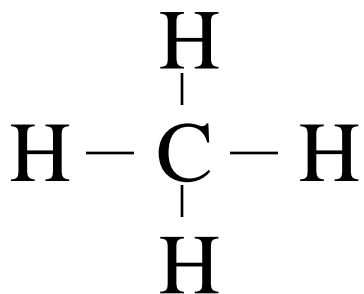
Prefix = # of carbons in chain

Suffix = -ane

CH_4	methane	natural gas
C_2H_6	ethane	
C_3H_8	propane	BBQ fuel
C_4H_{10}	butane	lighter fluid
C_5H_{12}	pentane	solvent
C_6H_{14}	hexane	component of gasoline
C_7H_{16}	heptane	solvent
C_8H_{18}	octane	component of gasoline
C_9H_{20}	nonane	
$\text{C}_{10}\text{H}_{22}$	decane	

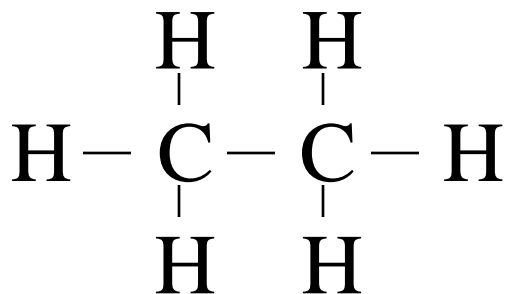
Structural Isomers

Compounds that have the same chemical formula but different arrangements of atoms



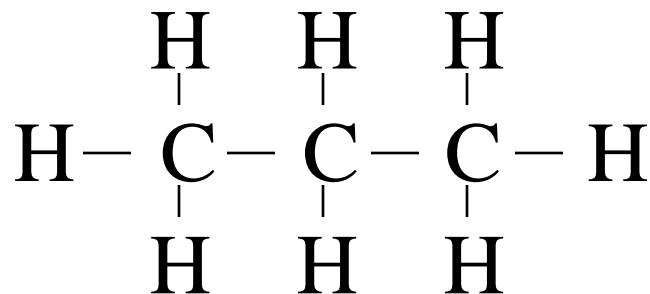
Methane

1 Isomer



Ethane

1 Isomer

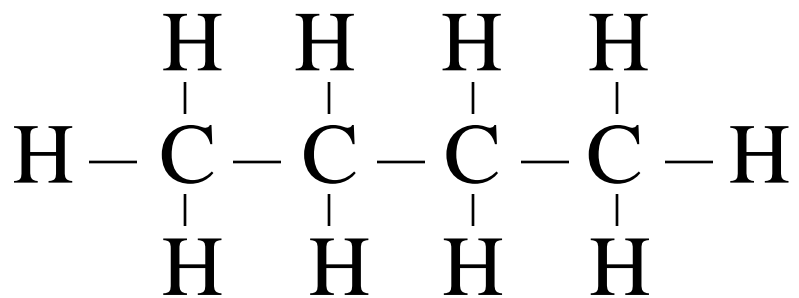


Propane

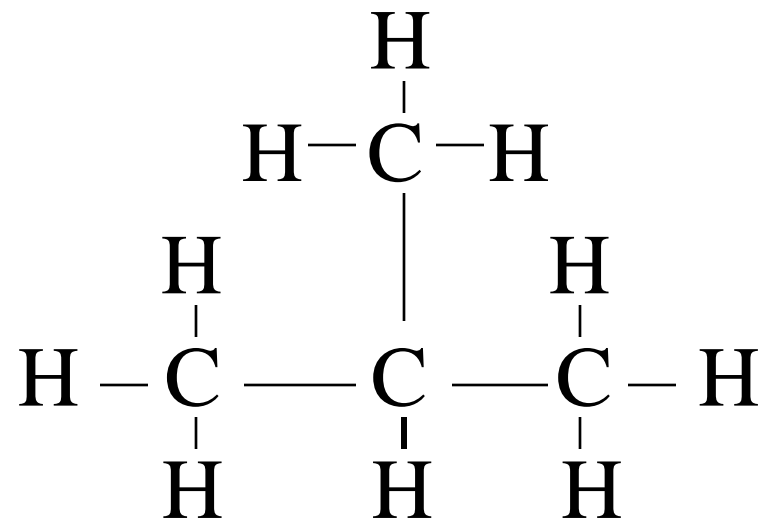
1 Isomer

There is only one possible arrangement for each of these compounds.

Structural Isomers of Butane



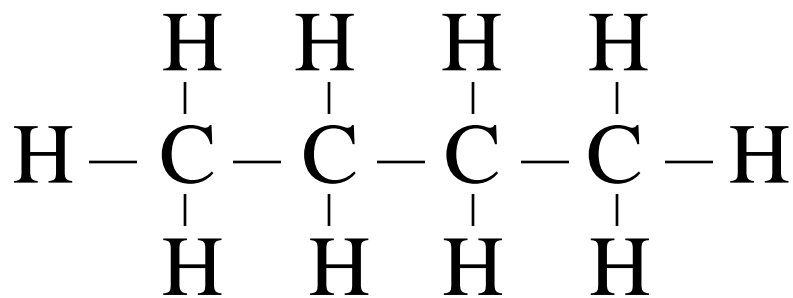
normal butane
(n-butane)



isobutane

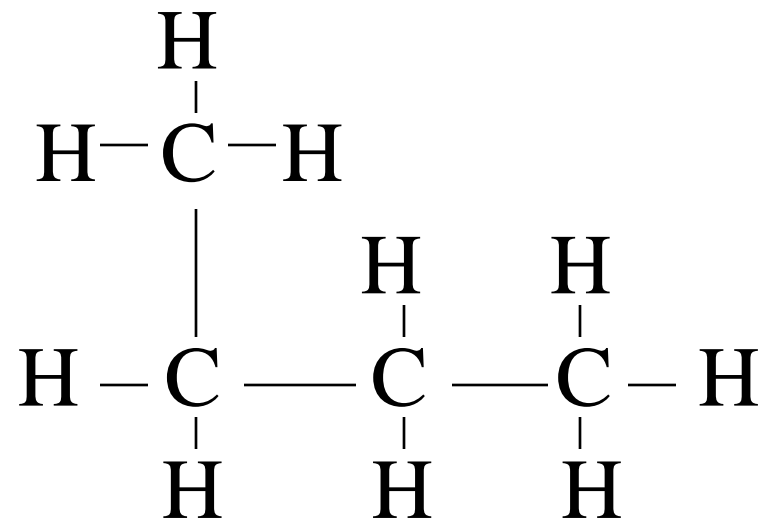
Butane has two isomers.

n - butane



normal butane

and



normal butane

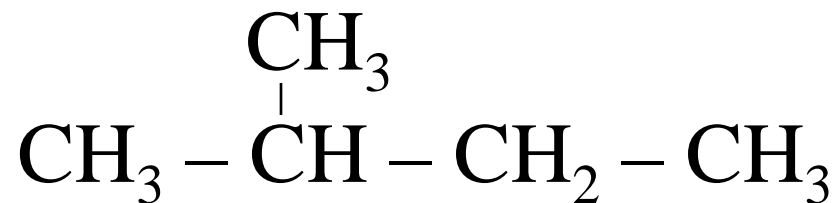
These two structures are the same.
They are not isomers.

Pentane has 3 Isomers

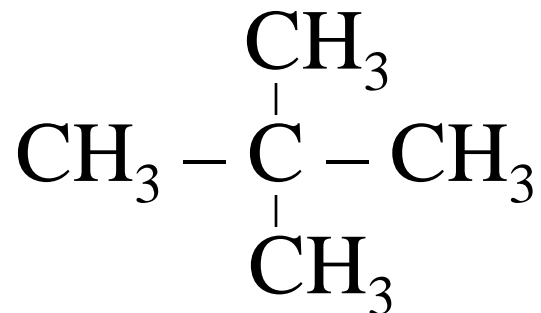
n-pentane



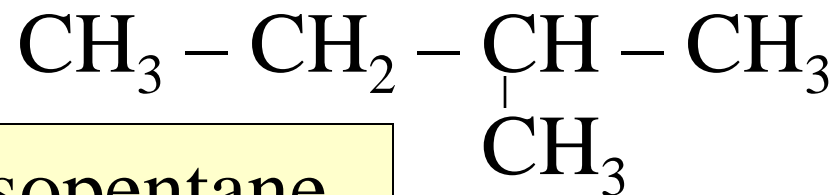
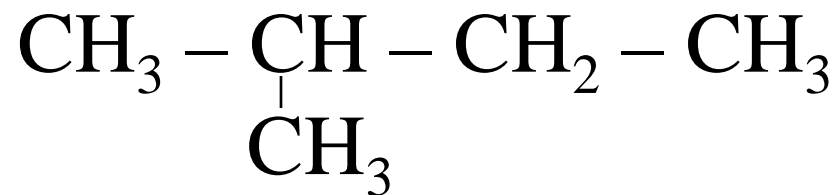
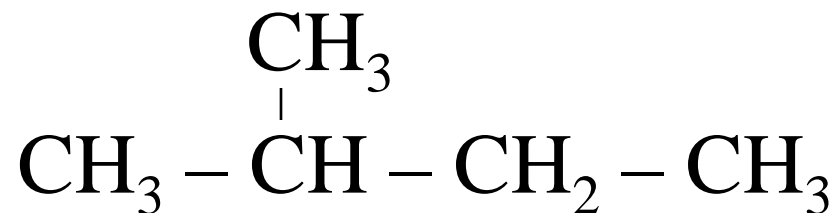
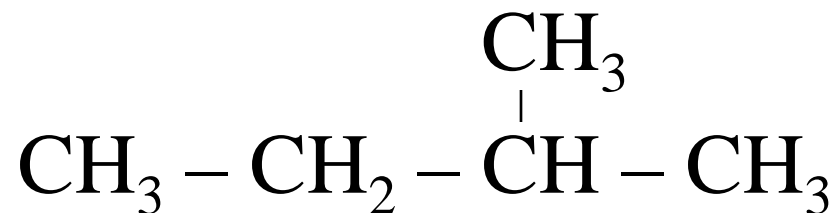
Isopentane



neopentane



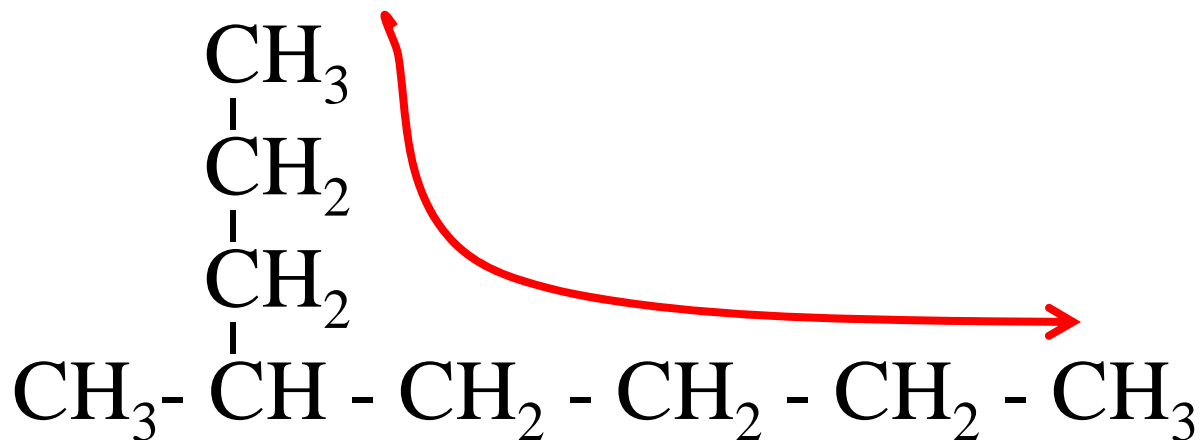
These are not different isomers



They are all isopentane

Nomenclature after Pentane

Step 1) Count the carbon atom in the longest continuous carbon chain.



8 carbon atoms in the longest carbon chain

It's an **Octane**.

Nomenclature after Pentane (cont.)

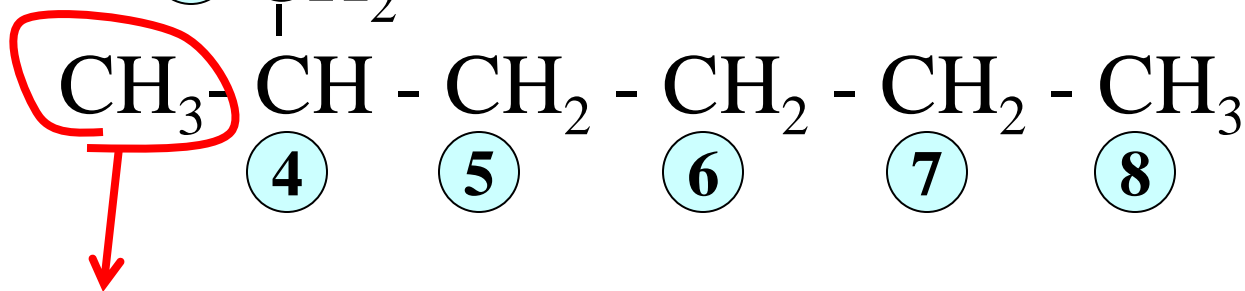
Step 2) Name the secondary alkane group according to the following chart.

- CH_3 methyl
- CH_2CH_3 ethyl
- $\text{CH}_2\text{CH}_2\text{CH}_3$ propyl
- $\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ butyl

- $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH} \\ | \\ \text{CH}_3 \end{array}$ isopropyl

Nomenclature after Pentane (cont.)

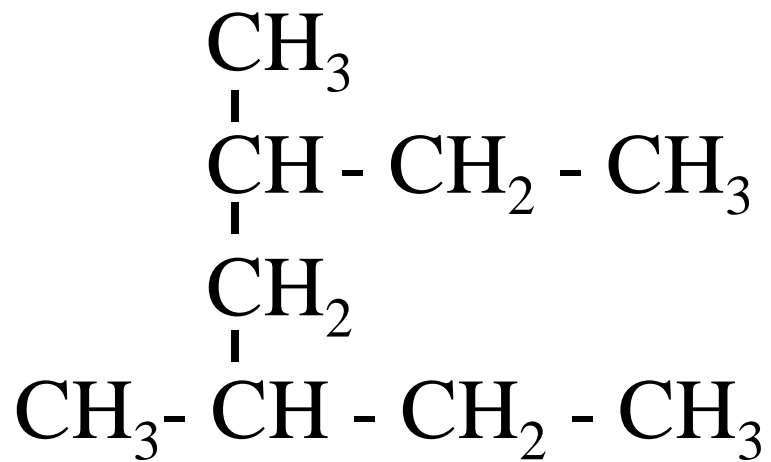
Step 3) Number the carbon chain so that the secondary alkane falls on the lowest possible number.



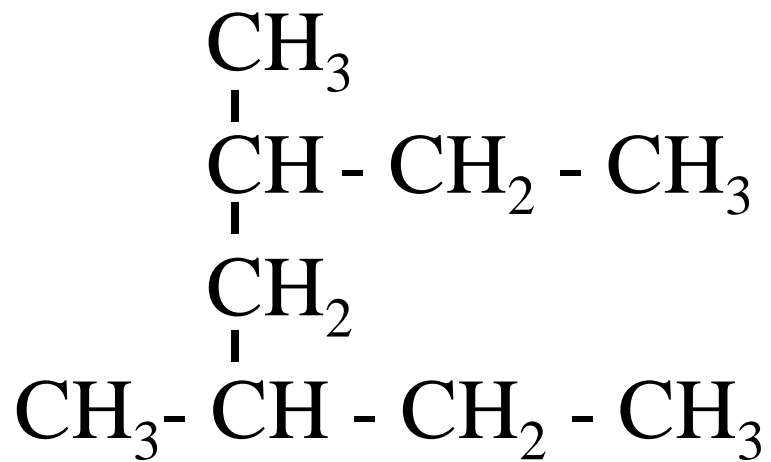
methyl

4-methyloctane.

Ex 1) Naming Alkanes



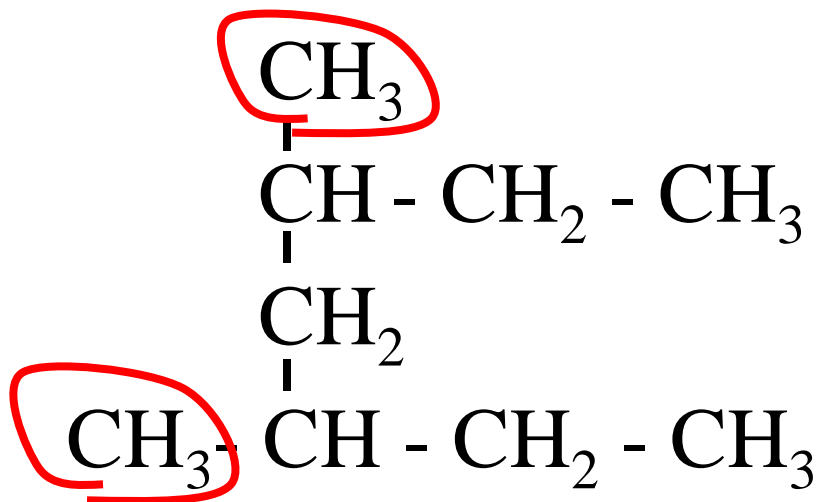
Ex 1) Naming Alkanes



Seven carbons in the longest chain.

heptane

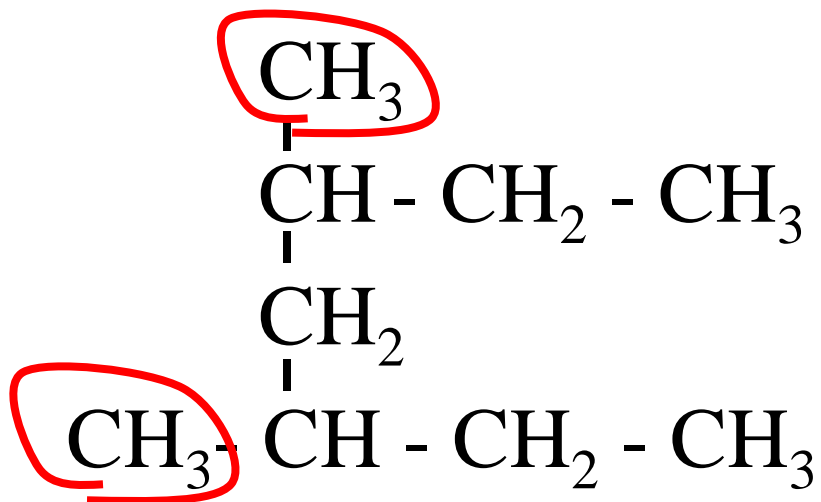
Ex 1) Naming Alkanes



Seven carbons in the longest chain.

dimethylheptane

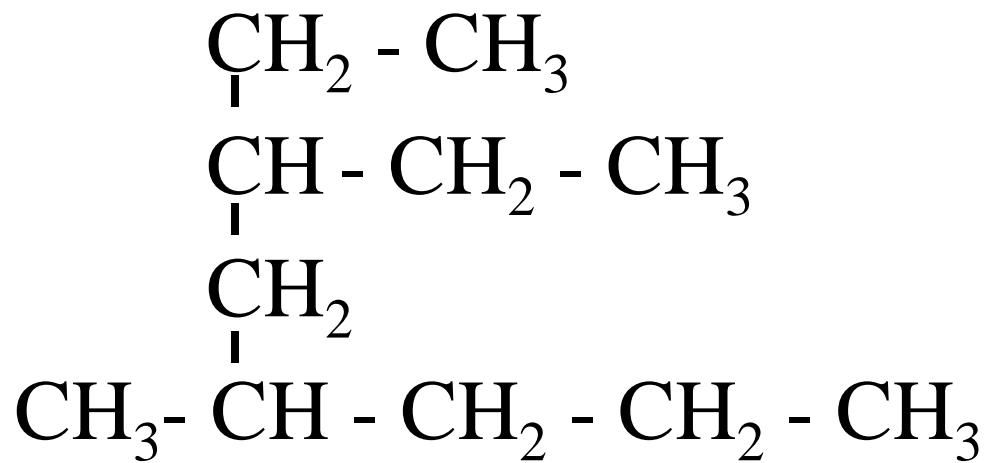
Ex 1) Naming Alkanes



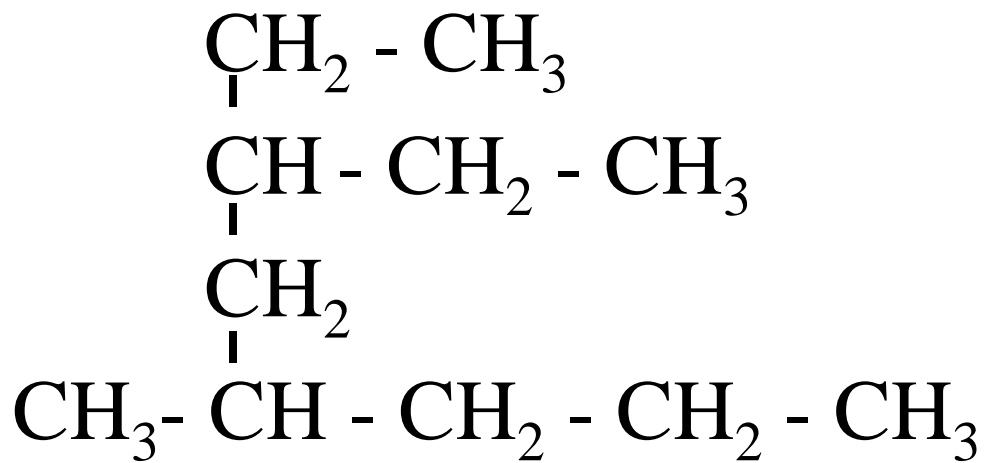
Seven carbons in the longest chain.

3, 5-dimethylheptane

Ex 2) Naming Alkanes



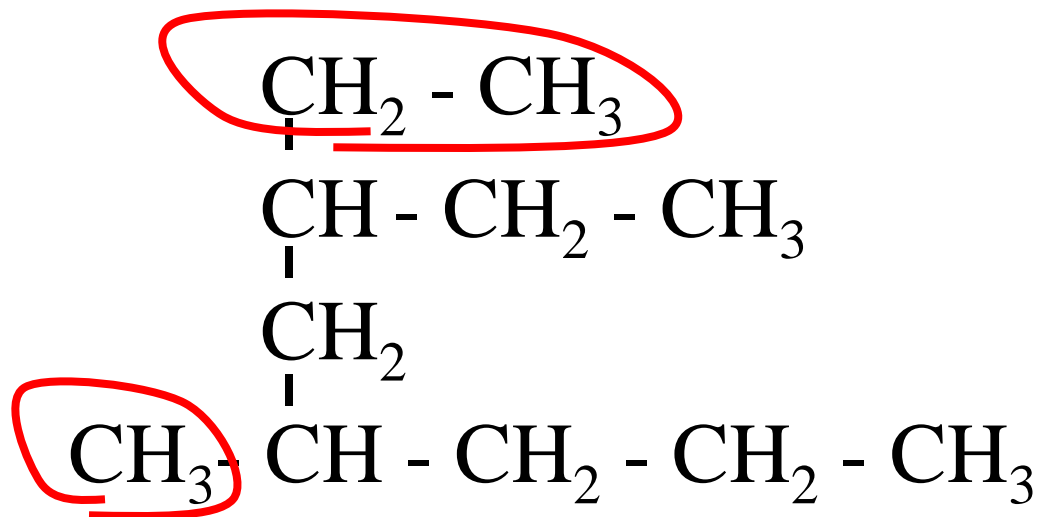
Ex 2) Naming Alkanes



Eight carbons in the longest chain.

octane

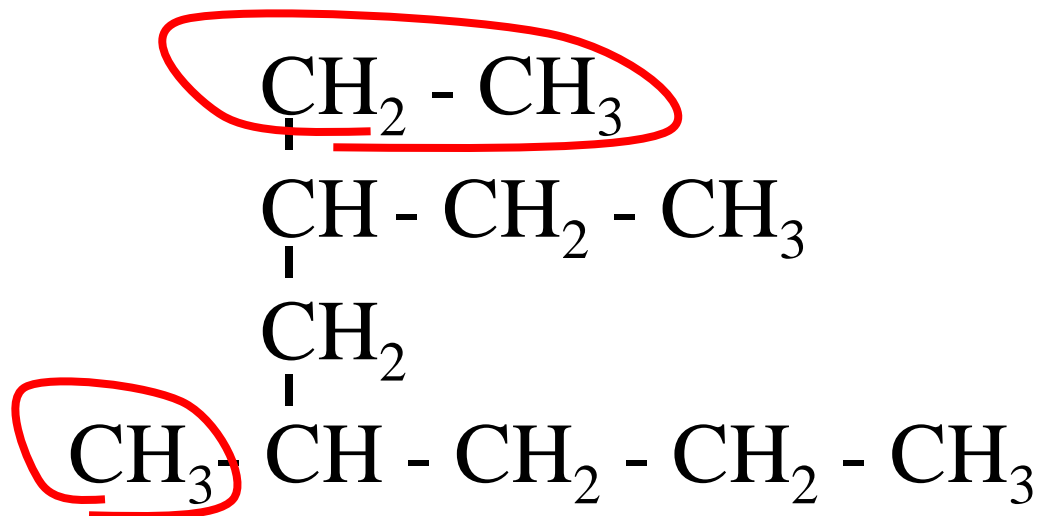
Ex 2) Naming Alkanes



Eight carbons in the longest chain.

-ethyl- -methyloctane

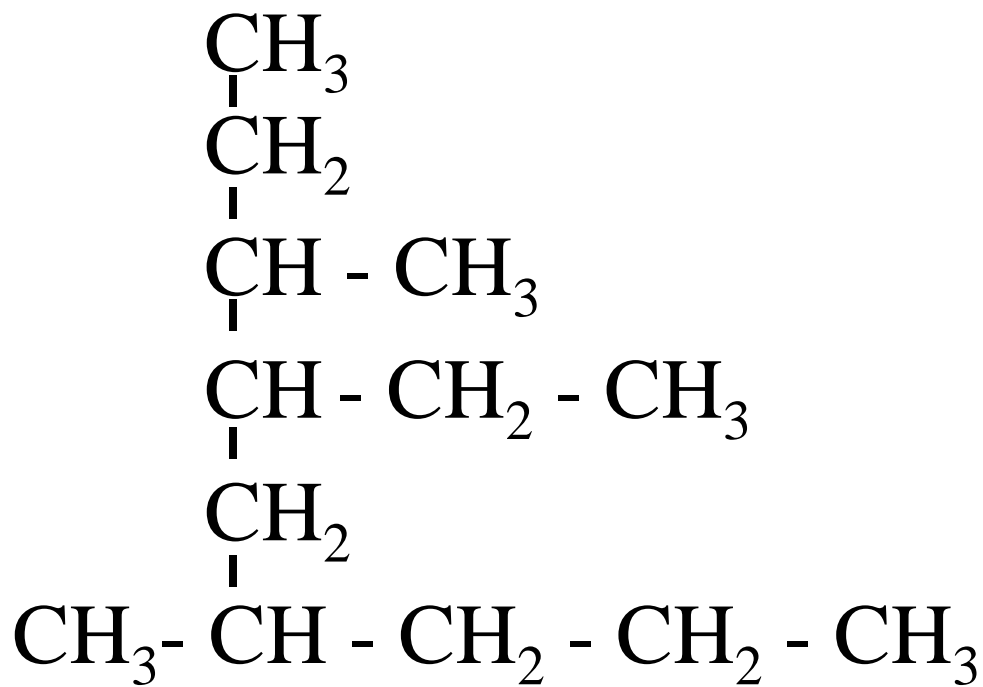
Ex 2) Naming Alkanes



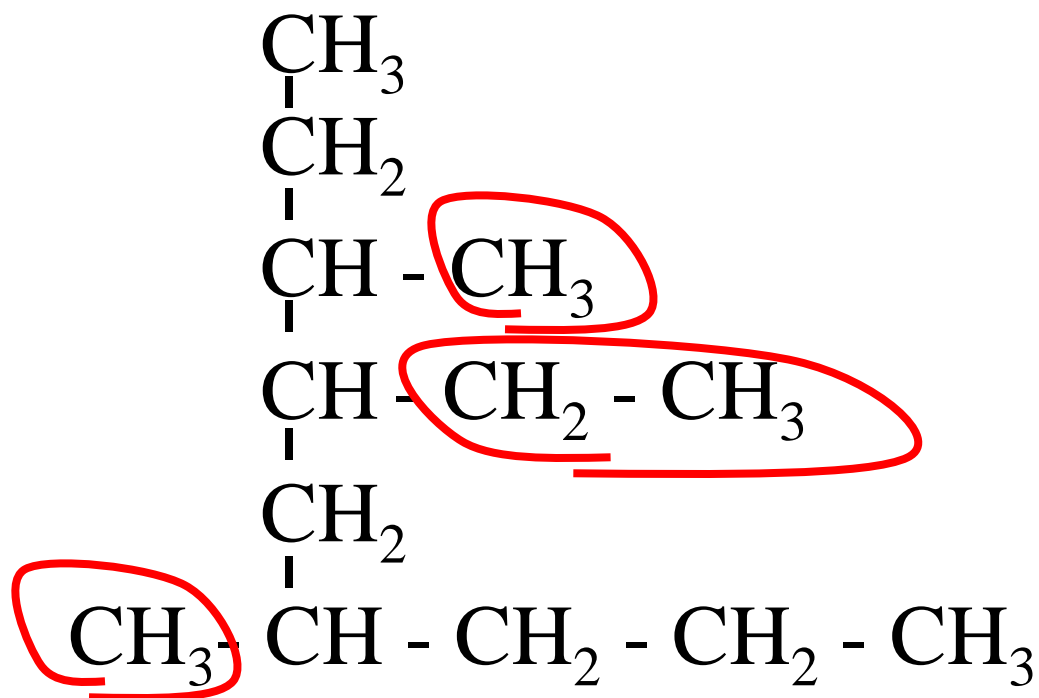
Eight carbons in the longest chain.

3-ethyl-5-methyloctane

Ex 3) Naming Alkanes



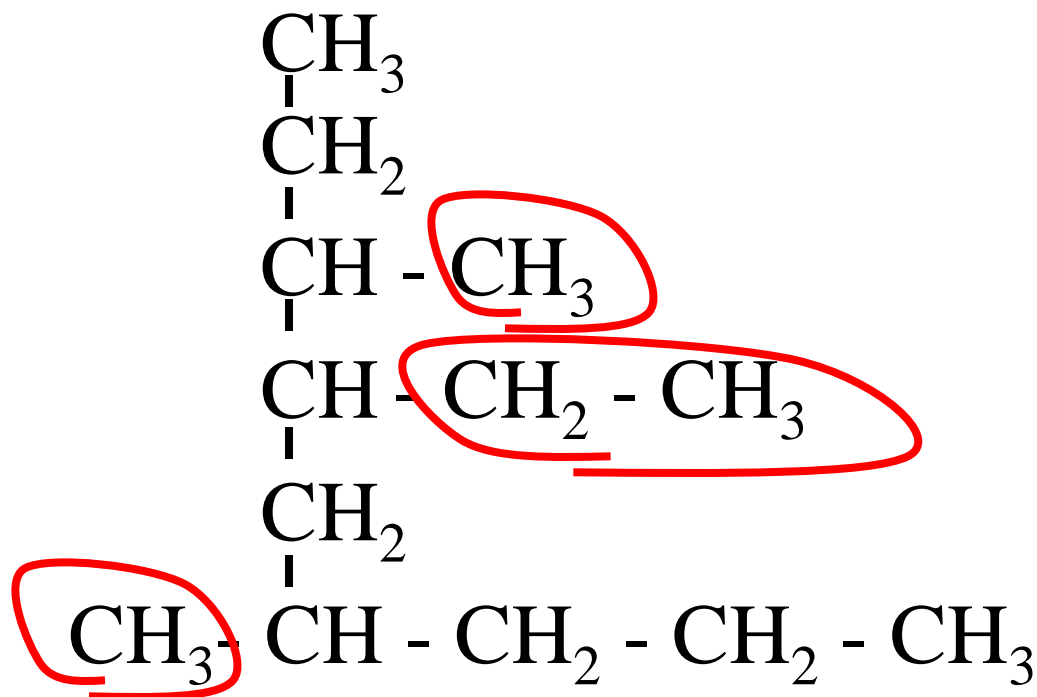
Ex 3) Naming Alkanes



Nine carbons in the longest chain.

nonane

Ex 3) Naming Alkanes

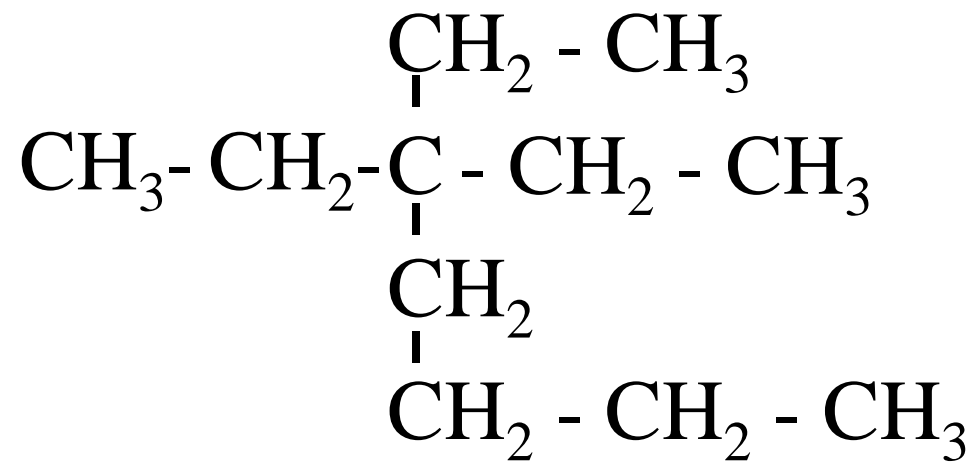


These prefixes are put in alphabetical order.

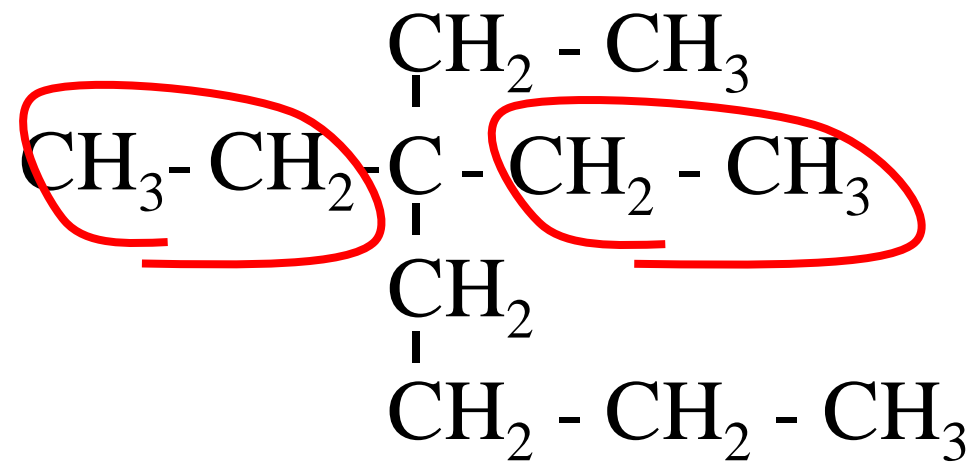
4-ethyl-3, 6-dimethylnonane

Not these ones.

Ex 4) Naming Alkanes

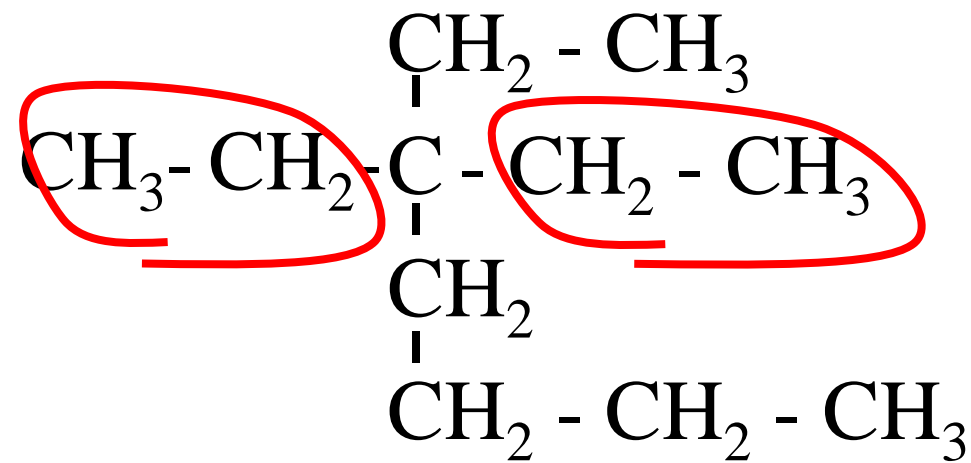


Ex 4) Naming Alkanes



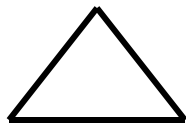
heptane

Ex 4) Naming Alkanes



3, 3-diethylheptane

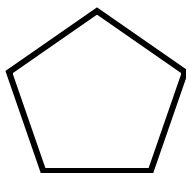
Cycloalkanes



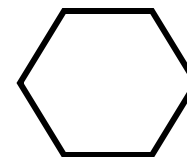
Cyclopropane



Cyclobutane



Cyclopentane

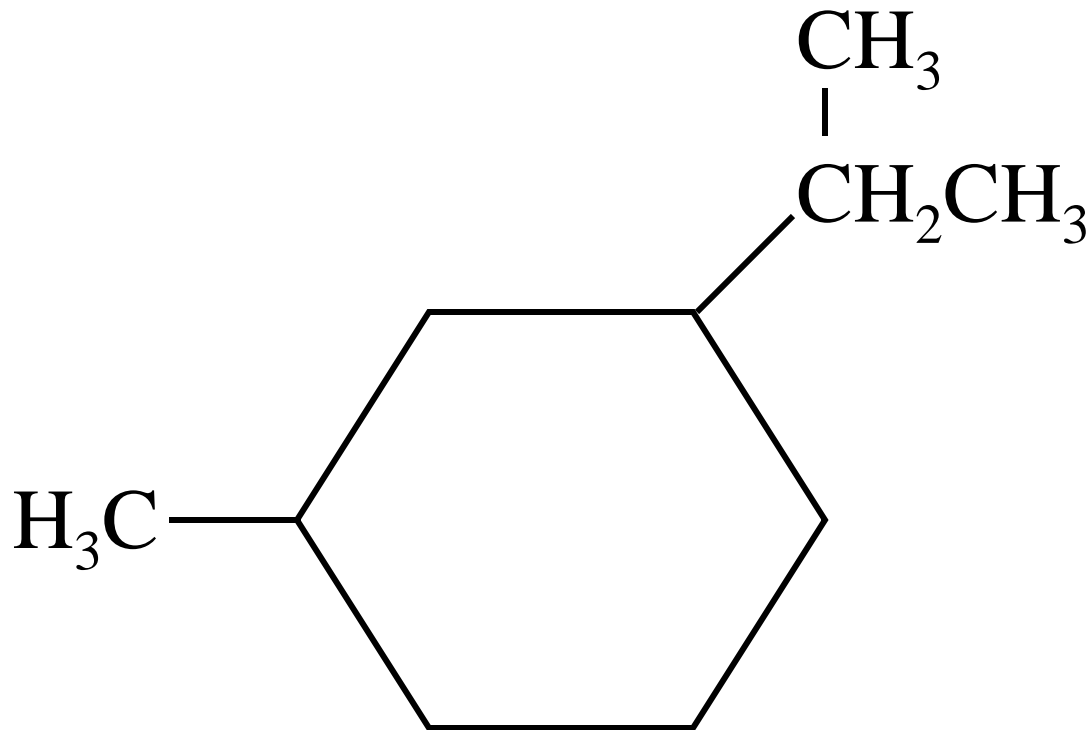


Cyclohexane

General formula C_nH_{2n}

Naming Cycloalkanes

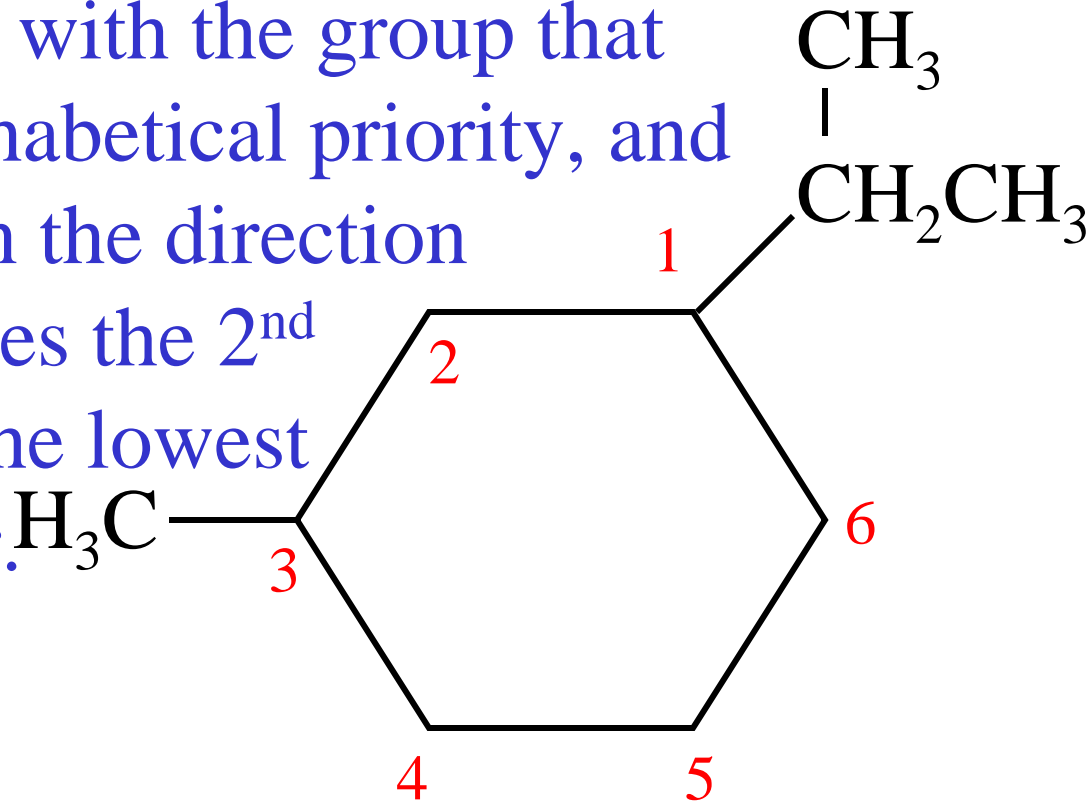
Step 1. Identify the Cycloalkane



cyclohexane

Naming Cycloalkanes

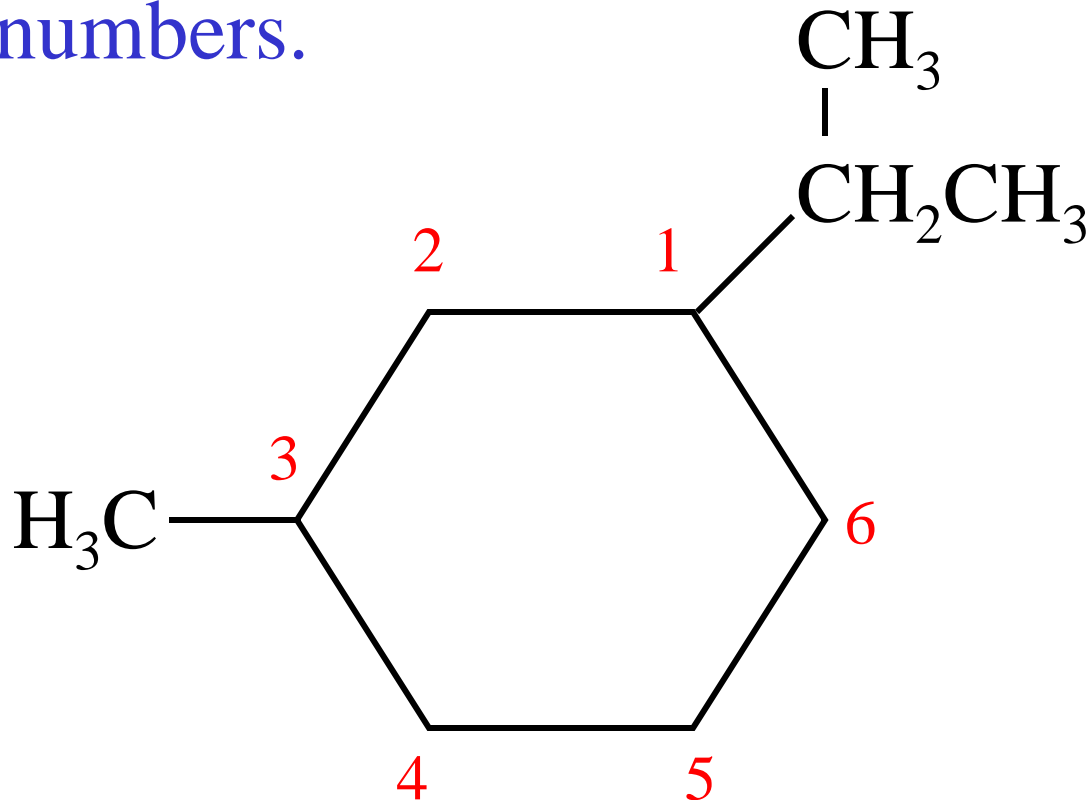
Step 2. Number the carbons in the cycloalkane by starting with the group that has alphabetical priority, and move in the direction that gives the 2nd group the lowest number.



cyclohexane

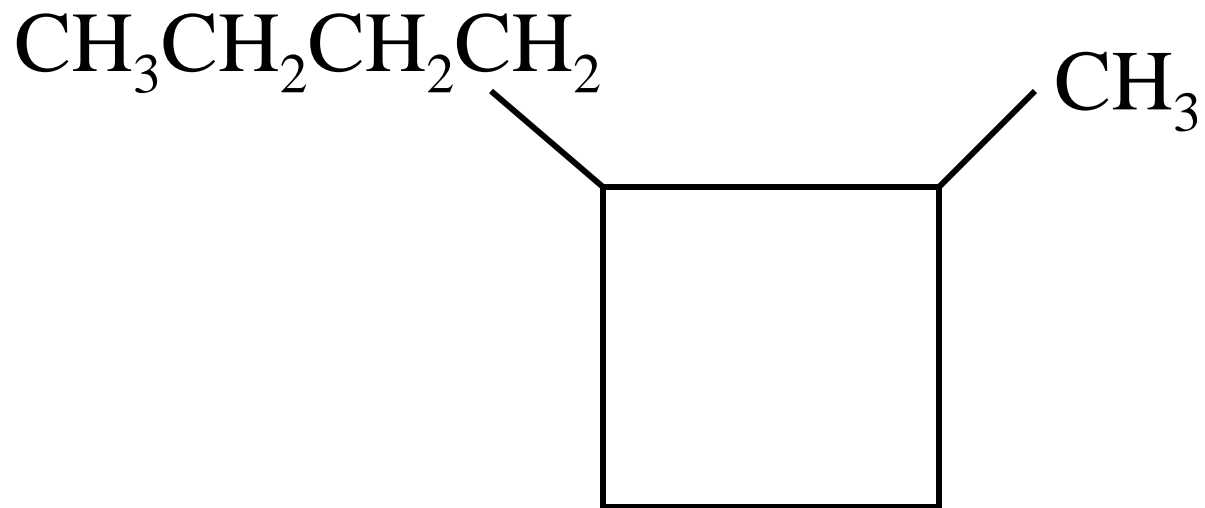
Naming Cycloalkanes

Step 3. Add the group names with their associated carbon numbers.

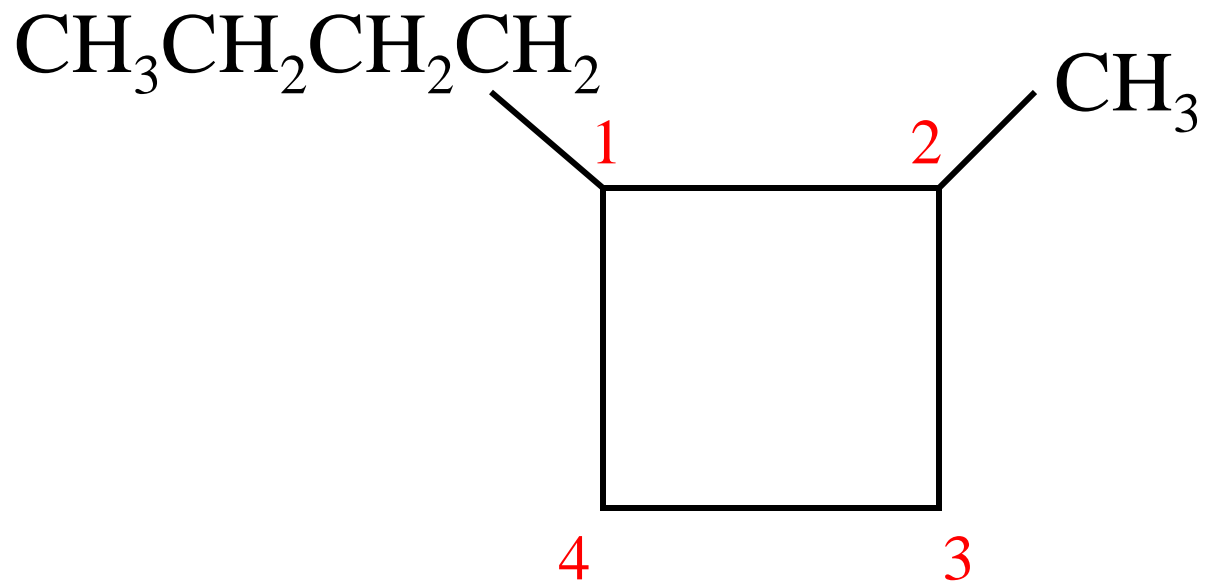


1-Isopropyl-3-methylcyclohexane

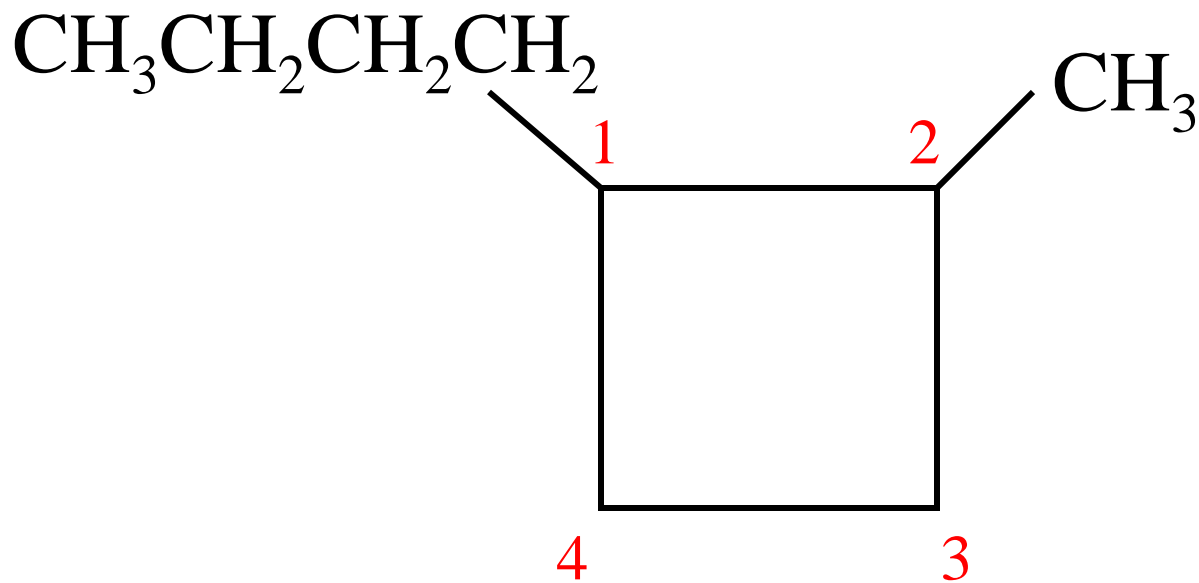
Ex) Name this Cycloalkane



Ex) Name this Cycloalkane



Ex) Name this Cycloalkane



1-Butyl-2-methylcyclobutane