Naming Organic Compounds

- Because there are several million organic compounds known, the IUPAC system of naming has been developed (IUPAC stands for International Union of Pure and Applied Chemistry).
- Each compound is named according to the number of carbon atoms it has in the longest continuous chain and the position of any functional groups or side chains.
- Prefixes and suffixes are used to identify the functional groups present
- The naming of the longest continuous chain is based on the root name:
- **The Root name** is a code which tells the number of carbons.

The Alkanes

- The alkane family represent the simplest of the hydrocarbons.
- General formula is C_nH_{2n+2} where 'n' equals the number of carbon atoms in the molecule
- The prefix in the name of each compound indicates the number of carbon atoms present.
- All alkanes have a suffix of *–ane*

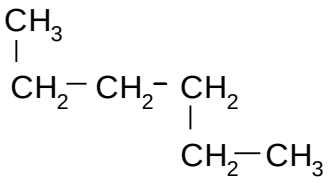
Give the name, molecular formula, structural formula and condensed structural formula of each of the first 8 alkanes:

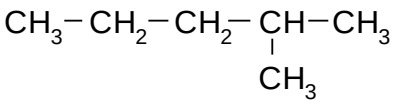
Prefix	No. of carbons	Name	Molecular Formula	Condensed Structural Formula
Meth	1			
Eth	2			
Prop	3			
But	4			
Pent	5			

Hex	6			
Hept	7			
Oct	8			

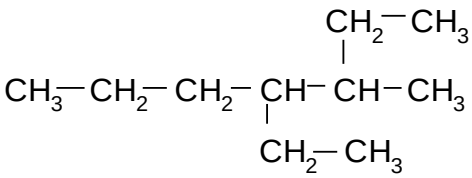
Alkyl Groups

- Carbon chains are not rigid structures. When we say that an alkane has a "straight" chain, we don't really mean straight. We mean it is a continuous chain, rather than a branched chain. The two structures below have 6 carbon atoms. The one on the left is "straight" while the one on the right is "branched"





- Most alkanes exist as "branched" molecules. The longest continuous chain is the parent chain and it doesn't have to be straight!.
- Once the parent is identified, the side chains are then named. These are called alkyl groups. Their general formula is C_nH_{2n+1} .
- Alkyl groups are named with the same prefixes as the alkanes. The suffix is changed from "ane" to "yl".



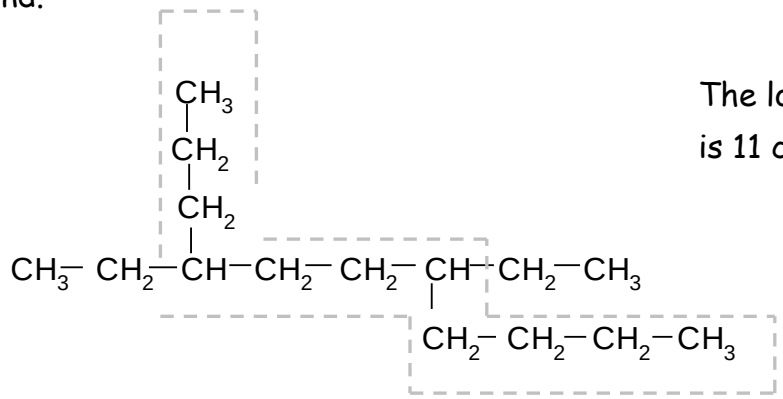
The longest continuous chain is 7 carbons ⇒ heptane

On carbon 3 is a methyl group and carbon 4 has an ethyl group so it is named 4 ethyl, 3 methyl heptane

- To name any alkane we need to follow a few rules

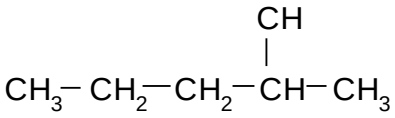
Rule 1:

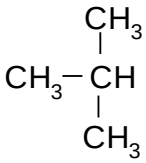
Locate the longest continuous chain of carbon atoms. This will give you the name of the "parent" compound.

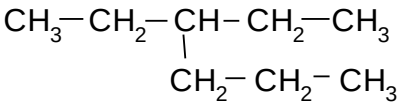


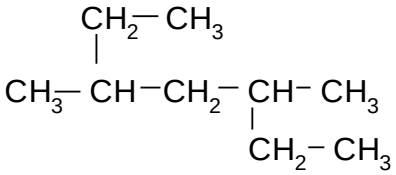
The longest continuous chain is 11 carbons.

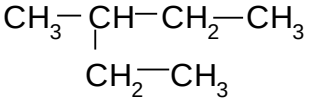
Draw a box around the longest continuous chain of carbon atoms in the structures below and name the parent compound for each one:

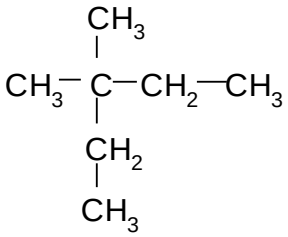










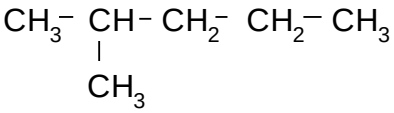


Rule 2:

The name of the parent compound is modified by noting what alkyl groups are attached to the chain. Number the longest chain so that the alkyl group(s) will be on the **lowest** numbered carbon.

Name the following alkanes given the first one:

2 methyl pentane



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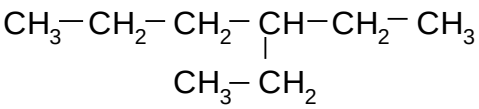

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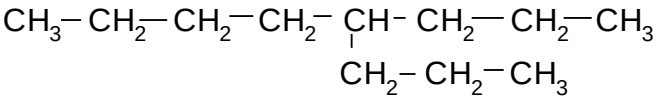

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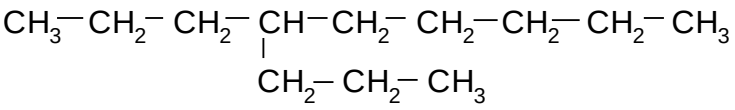
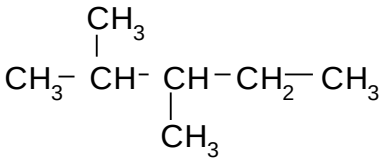


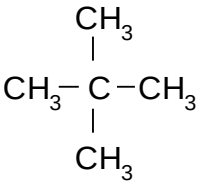
Rule 3:

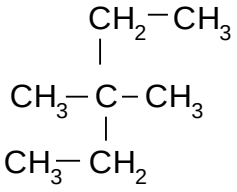
When the same alkyl group occurs more than once in a molecule, the numbers of the carbons to which they are attached are all included in the name. The number of the carbon is **repeated** as many times as the group appears. The number of repeating alkyl groups is indicated by the use of prefixes; di, tri, tetra, etc….

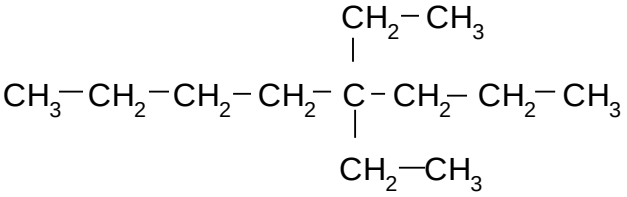


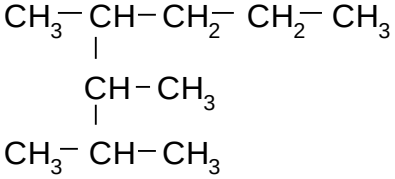
2,3 dimethylpentane

Name the four molecules whose structures are drawn below:









A _____

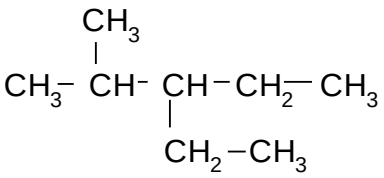
B _____

C _____

D _____

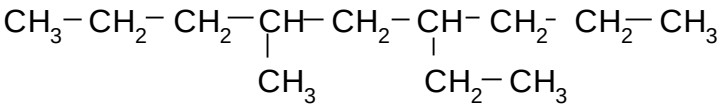
Rule 4:

If there are two or more different kinds of alkyl groups attached to the parent chain, name them in alphabetical order.

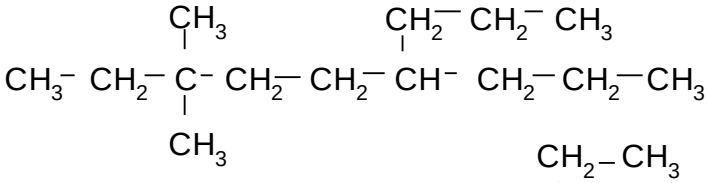


3 ethyl 2 methylpentane
NOT 2 methyl 3 ethyl pentane

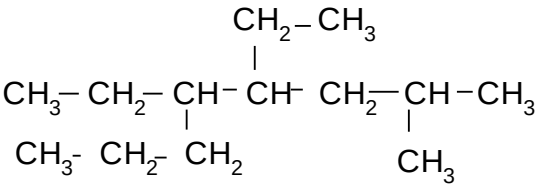
Name these four molecules



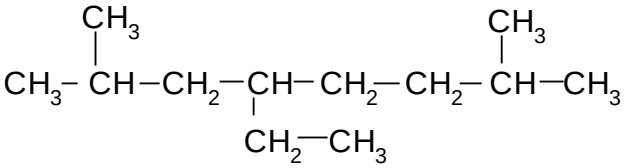
A: _____



B: _____



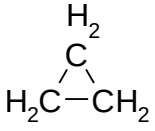
C: _____



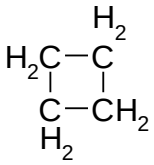
D:

Cyclic Alkanes

- Carbon atoms can form rings which result in the formation of cyclic alkane molecules with the general formula C_nH_{2n}



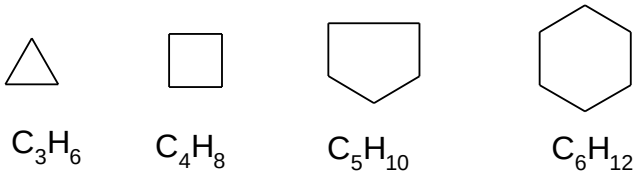
cyclopropane



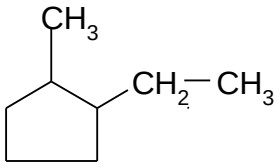
cyclobutane

- The name of a cyclic molecule requires the addition of the prefix "cyclo"

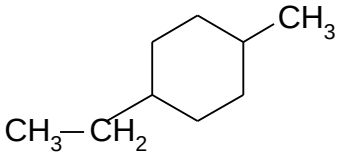
- To make cyclic compounds easier to draw, a shorthand is used in which the hydrogens and carbons which are part of the ring are not represented at all. The proper number or hydrogens is assumed to be attached to each carbon.



- Like the straight chained compounds, cyclic molecules can contain alkyl side chains. The carbon on which the alkyl group is **automatically** assumed to be number 1 and is not needed in the naming **unless** there is more than one alkyl group!
- If there is more than one substituent on a ring, numbers must be given. One is always assigned number 1 (usually the first alphabetically ie ethyl before methyl) then the chain is numbered clockwise or anticlockwise so as to give the other alkyl groups the smallest possible number.



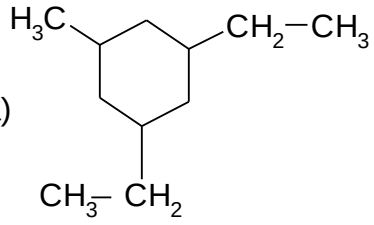
1 ethyl 2 methylcyclopentane



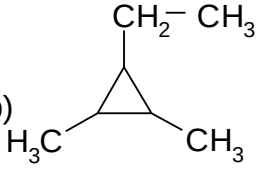
1 ethyl 4 methylcyclohexane

Name the following molecules:

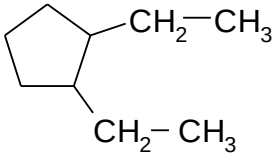
a)



b)



c)



Naming alkenes

- Alkenes contain at least one double bond which exists between a pair of carbon atoms.
- The general formula is C_nH_{2n}
- The suffix used is "-ene"

Rule 1:

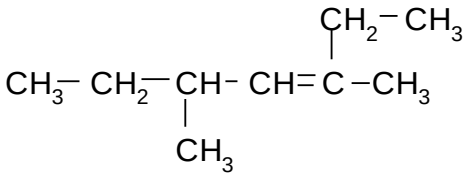
The chain chosen as the parent must contain the double bond

Rule 2:

The parent chain must be numbered to give the double bond the lowest possible number

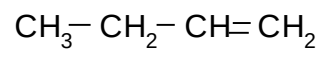
Rule 3:

The name of the alkene must contain a number to indicate the position of the double bond if there are more than 3 carbons



3,5 dimethyl hept-3-ene

Name the alkenes below:



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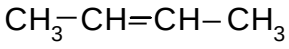

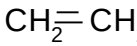

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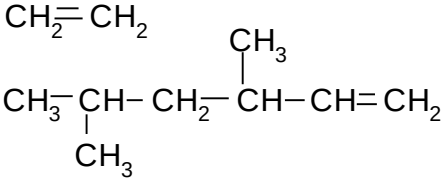

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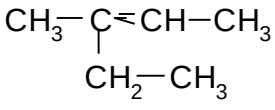

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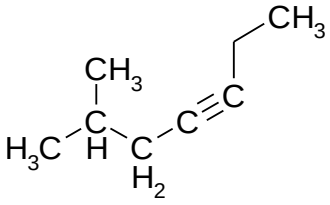
Naming Alkynes

- The functional group is a triple bond
- The general formula is C_nH_{2n-2}
- The triple bond must be in the parent chain and assigned the lowest possible number



5 methyl hex-2-yne

Name the alkynes below: