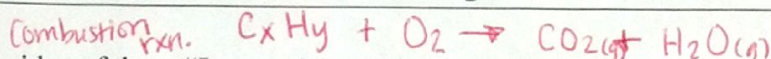


22 • Organic Chemistry



LECTURE NOTES 1

The idea of these "Lecture Notes" is for you to take notes normally during the lecture and activities and then go back over your notes to fill in the missing information on this page from memory.

Hydrocarbons Are Good Fuels

Hydrocarbons are made up of two elements:

Name	Symbol	Model Color	# of Holes
Carbon	C	black	4 (v.e.)
Hydrogen	H	white	1 (v.e.)

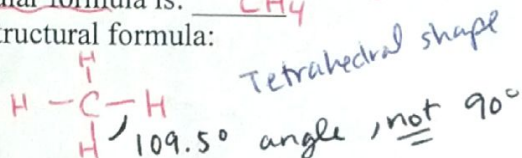
If you make a simple molecule using 1 black carbon, you will use 4 white hydrogens.

The name of this molecule is: methane

It is commonly found in: natural gas

The molecular formula is: CH₄

Draw the structural formula:



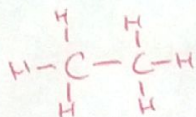
If you make a molecule using 2 black carbons, you will use 6 white hydrogens.

The name of this molecule is: ethane

It is commonly found in: natural gas

The molecular formula is: C₂H₆

Draw the structural formula:



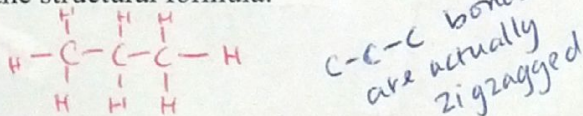
If you make a simple molecule using 3 black carbons, you will use 8 white hydrogens.

The name of this molecule is: propane

It is commonly found in: bbq grills

The molecular formula is: C₃H₈

Draw the structural formula:



Structural Formulas Can Be Misleading

List at least two ways that structural formulas can give you wrong information about the molecule:

- 1) molecules look FLAT instead of tetrahedral
- 2) bond angles look like 90° & 180° instead of 109.5°

Counting to 10 in Chemistry (memorize this)

Carbon #	Prefix	Mol. Form.	Fuel Name
1	meth-	CH ₄	<u>methane</u>
2	eth-	C ₂ H ₆	<u>ethane</u>
3	prop-	C ₃ H ₈	<u>propane</u>
4	but-	C ₄ H ₁₀	<u>butane</u>
5	pent-	C ₅ H ₁₂	<u>pentane</u>
6	hex-	C ₆ H ₁₄	<u>hexane</u>
7	hept-	C ₇ H ₁₆	<u>heptane</u>
8	oct-		
9	non-		
10	dec-		

Generalized Formula for Hydrocarbons

From the chart above, what is a generalized molecular formula for a hydrocarbon, that is, if you have n carbon atoms, how many hydrogen atoms will you have? 2n+2

Generalized Formula: C_nH_{2n+2} (Alkane)

Substituted Hydrocarbons

* all single bonds

Our model kits have spheres for one element that can substitute for the white hydrogens:

Color	Name	Symbol	# of Holes
green	<u>chlorine</u>	<u>Cl</u>	1 (7v.e.)

Name	Molecular Formula	Structural Formula
Chloromethane	<u>CH₃Cl</u>	

How many different ways (isomers) can you put these atoms together? 1

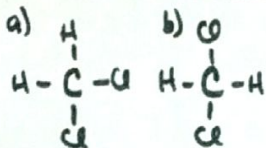
Substituted Hydrocarbons (continued)

"iso" means same

"mer" means parts

isomer = same parts (molecular formula) but different structures

Dichloromethane can be drawn different ways:



What is different about these? NOTHING

Are they isomers? NO Explain.

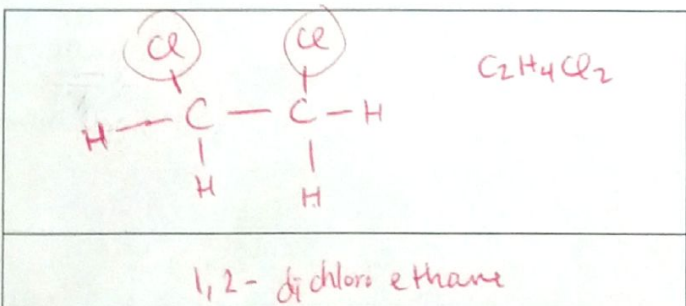
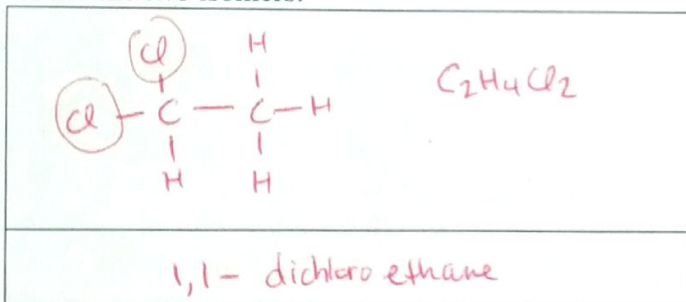
They are the same; just rotated.

Another Example

If you use two greens, two blacks, and four whites

the molecular formula is: $\text{C}_2\text{H}_4\text{Cl}_2$

This molecule (dichloroethane) has two distinct isomers. Draw the two structural formulas and name the two isomers:



Parent Chains and Side Groups

Naming these molecules involves identifying the longest continuous chain of carbon atoms, naming it, numbering the carbon atoms, and listing the side groups.

Side Groups

Side Group	-Cl	-Br	-I	-CH ₃	-C ₂ H ₅
Name	chloro-	bromo-	iodo-	methyl-	ethyl-

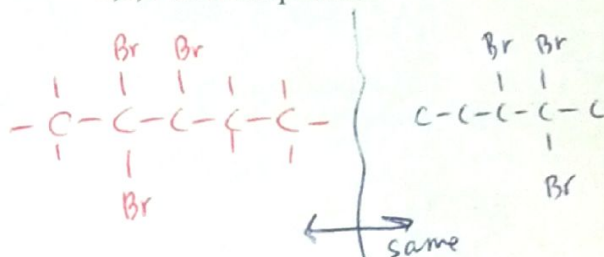
propyl - C₃H₇
butyl - C₄H₉

Counting Side Groups

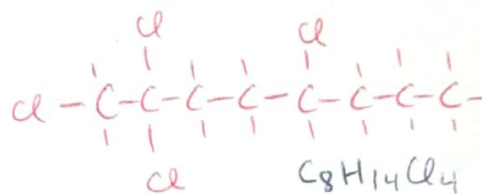
1	2	3	4	5
---	di-	tri-	tetra-	penta-

Draw the molecule:

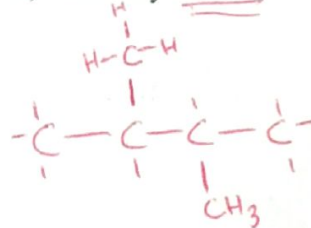
2,2,3-tribromopentane



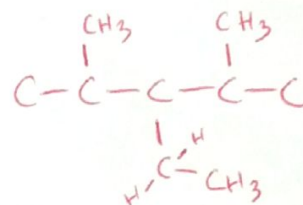
1,2,2,5-tetrachlorooctane



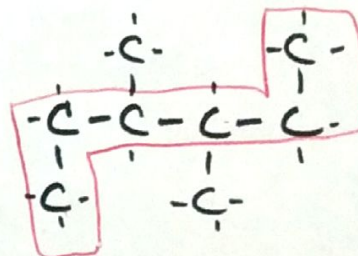
2,3-dimethylbutane



2,4-dimethyl-3-ethylpentane



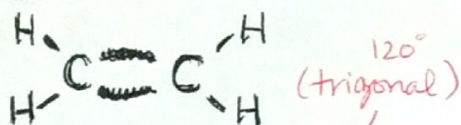
Name the molecule:



3,4-dimethylhexane

Double Bonds

Two atoms can bond together twice. For this we need to use two of the flexible bonds. Here is the structural formula:



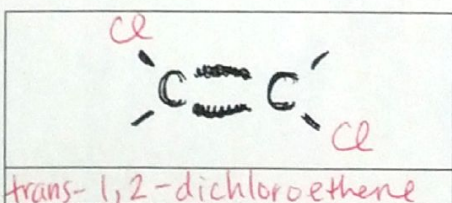
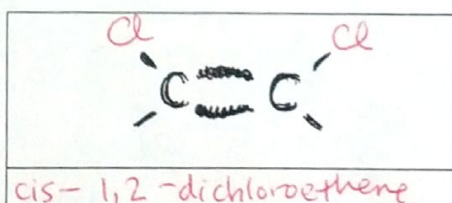
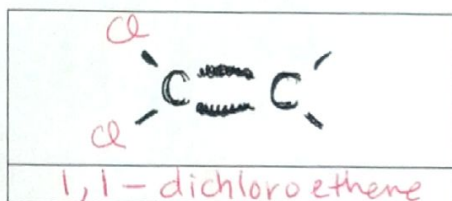
The shape of the whole molecule is flat/planar

What is different about the C=C double bond and the C—C single bond in ethane? The double bond cannot rotate

This molecule is called ethene. It is part of the hydrocarbon group called the alkenes and has the general formula C_nH_{2n} .

Substituted Alkenes

There are **three** isomers of **dichloroethene**. Draw and name them.



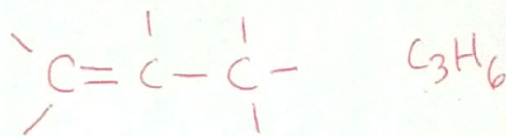
In your own words, explain cis- and trans- isomers:

cis - both side groups are on the same side of the double bond

trans - side groups are across the double bond

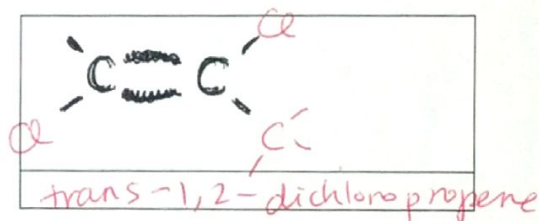
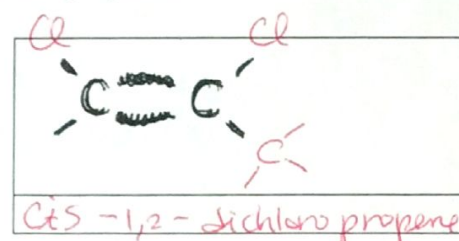
Propene

Draw the structural and molecular formula for propene (one double bond only).



Number the carbons; begin at the side nearest to the double bond.

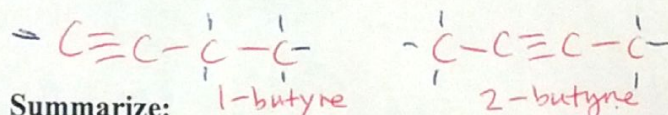
Draw and name the two isomers of: 1,2-dichloropropene.



Triple bonds

If a molecule has three bonds between the carbon atoms, it is called an alkyne.

Draw the **structural formula** for **ethyne** and write its **molecular formula**:



Summarize:

Hydrocarbon	Bonding	Gen. Formula
alkane	all single bonds	C_nH_{2n+2}
alkene	one double bond	C_nH_{2n}
alkyne	one triple bond	C_nH_{2n-2}

Saturated
Unsaturated