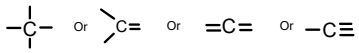
7.1 - Introduction to Hydrocarbons

Names in Booklets!!!

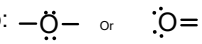
Add CnH2n+2

1. Review!

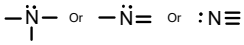
A. How many bonds maximum can carbon have?

Four: 

B. How many bonds maximum can oxygen have?

Two: 

C. How many bonds maximum can nitrogen have?

Three: 

D. How many bonds maximum can hydrogen have?

One: H—

Organic Compounds

Hydrocarbon – a compound containing only carbon and hydrogen.

Organic Compounds - contain C and H, and (usually) non-metallic elements: oxygen, nitrogen, sulfur, phosphorus, halogens, etc.

Exceptions: Oxides of carbon (CO_2, CO), carbides (Ex: CaC_2), carbonates ($CaCO_3$).

Origins

Petroleum (oil) deposits contain the majority of hydrocarbons used in industry.

Oil is pumped out of the ground, and refined using distillation to separate specific sizes of molecules.

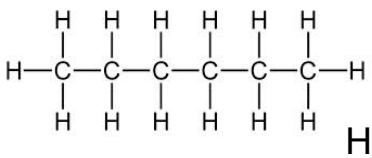
Smaller molecules boil at lower temperatures, larger ones at higher.

Different sizes are used as fuel, or in an infinite number of compounds, from medicines to plastics.

Straight Chain Alkanes

Alkane: hydrocarbon with only **single** bonds: carbon atoms line up sequentially.

The names end in *-ane*.



Hexane

Parent Group Prefixes

Resources Page 1 - don't copy this down!

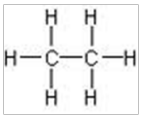
Prefix	Carbons	Prefix	Carbons
meth-	1	hex-	6
eth-	2	hept-	7
prop-	3	oct-	8
but-	4	non-	9
pent-	5	dec-	10

Chem Unit 7.1 Notes - Hydrocarbons, Naming Alkanes

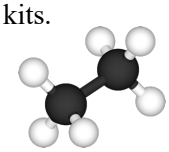
Modeling Hydrocarbons

(Molecular or Chemical) Formula: C_2H_6

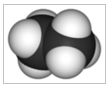
Structural Formula: Like Lewis Structures: shows all atoms and bonds. But: no lone pairs.



Ball and Stick: like our modeling kits.



Space Filled: no bonds shown.



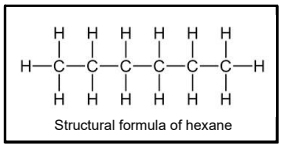
Line Structure Shorthand

Shows bonds, structure, and saves time!

Lines indicate bonds between carbon; angles and ends represent carbon atoms.

Do not draw hydrogen atoms; other elements MUST be included.

Example: Hexane - C_6H_{14} (Click on the structure to show transformation)

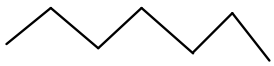


Structural formula of hexane

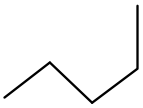
2. Examples

Name the following molecules.

A.

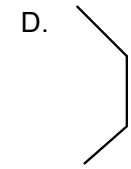


B.



C.

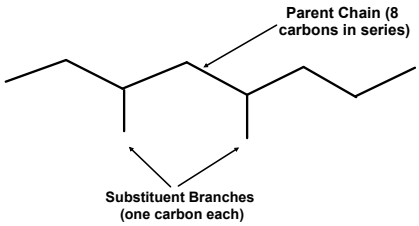
D.



Branched Chain Alkanes

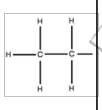
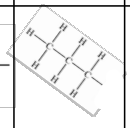
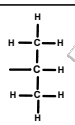
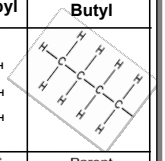
Substituent group: replaces a hydrogen atom in a hydrocarbon parent chain.

Alkyl group: a branch with single bonds.



Possible Substituents

Resource Page 1.

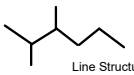
Name:	Methyl	Ethyl	Propyl	Isopropyl	Butyl
Structural Formula					
Line Structure	 Parent Chain	 Parent Chain	 Parent Chain	 Parent Chain	 Parent Chain

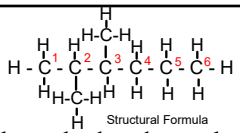
Naming Alkanes

A systematic way of indicating types and positions of side chains had to be made to standardize molecular nomenclature.

IUPAC (International Union of Pure and Applied Chemistry) rules apply.

Naming Branched Alkanes

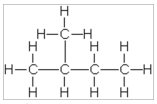

Line Structure


Structural Formula

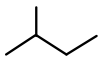
1. Determine parent name: from branched end, number carbon atoms in the longest chain (Ex: 6 C = hexane)
2. List substituents alphabetically, and their numbered positions. (Ex: 2-methyl, and 3-methyl)
3. Indicate how many of each substituent with prefixes (di-, tri-, tetra-, etc.) (Ex: 2,3-dimethyl)
4. Write name: separate numbers and words with hyphens, and separate numbers with commas. (Ex: 2,3-dimethylhexane)

3. Naming Guided Practice

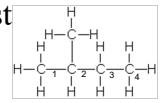
Name the following molecule:

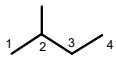

Structural Formula

=


Line Structure

1. Number longest carbon chain:
   4 = butane

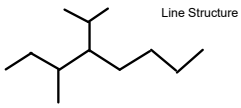




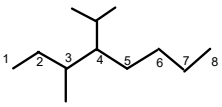
2. Number 2 has a methyl (one carbon) side chain.
3. Entire name: 2-methylbutane

4. Guided Practice

Name the following molecule:


Line Structure

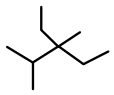
1. Number longest carbon chain:
   8 = octane



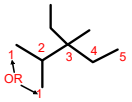
2. Number 3 has a methyl, and number 4 has an isopropyl side chain.
3. Entire name: 4-isopropyl-3-methyloctane

5. Example

Name the following molecule:



1. Number longest chain (from branched end): 5 = pentane

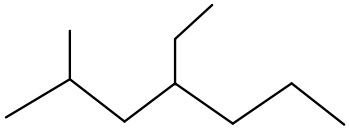


2. Positions 2, and 3 have side chains.
3. Substituents: one ethyl and two methyl.
4. Name segments: 3-ethyl and 2,3-dimethyl

Entire name: 3-ethyl-2,3-dimethylpentane

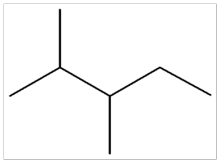
6. Example

Draw 4-ethyl-2-methylheptane:

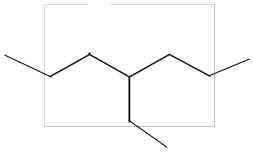


7. More Examples

A. 2,3-dimethylpentane:



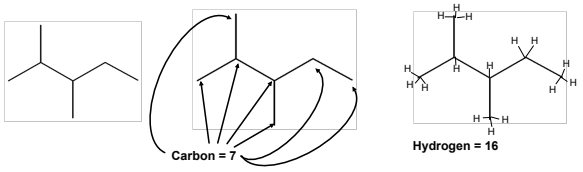
B. 4-ethylheptane:



Determining Formulas

You can figure out a hydrocarbon's formula from its line structure:

1. Count ends and angles to determine carbon.
2. Every carbon needs four bonds - bonds not shown going to a neighboring carbon go to an implied hydrogen atom.

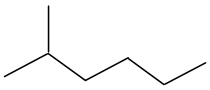


Formula = C_7H_{16}

8. Try This!

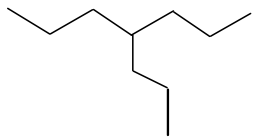
Identify and write the formulas of the following alkanes:

A.



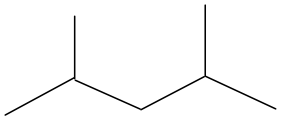
Name: 2-methylhexane
Formula: C_7H_{16}

C.



Name: 4-propylheptane
Formula: $C_{10}H_{22}$

B.



Name: 2,4-dimethylpentane
Formula: C_7H_{16}

Homework

7.1 Problems in your Booklet.
Due next class.