Chemistry 30 - Organic Chemistry Unit
Outcomes Summary

Welcome to Organic Chemistry. This unit is broken down into two separate learning outcomes. Each will take a number of classes to accomplish. At the end of each outcome there will be an assignment and a quiz. There will be a Unit test on both outcomes.

Outcome 1 - Hydrocarbon and Oil refining (4 classes)

Part 1 - Alkanes and Structural Isomers

Part 2 - Alkenes and Alkynes

Part 3 - Aromatics and Refining

Outcome 2 - Hydrocarbon Derivatives and Organic Reactions (7 classes)

Part 1 - Organic Halides, Alcohols and Carboxylic Acids

Part 2 - Addition and Substitution Reactions

Part 3 - Elimination and Combustion Reactions

Part 4 - Esterfication Reactions

Part 5 - Polymerization Reactions

Chemistry 30:
Unit 1: Organic Chemistry

What are organic Compounds?

(def) – an organic compound is a compound that contains the carbon atom

Exceptions (not organic compounds)
- Ionic compounds containing carbon (ex. Na_2CO_3)
- Oxides of carbon (CO, CO_2)
- inorganic acids (HCN, H_2CO_3)

*

Organic compounds fall into two categories:

1. **Hydrocarbons**

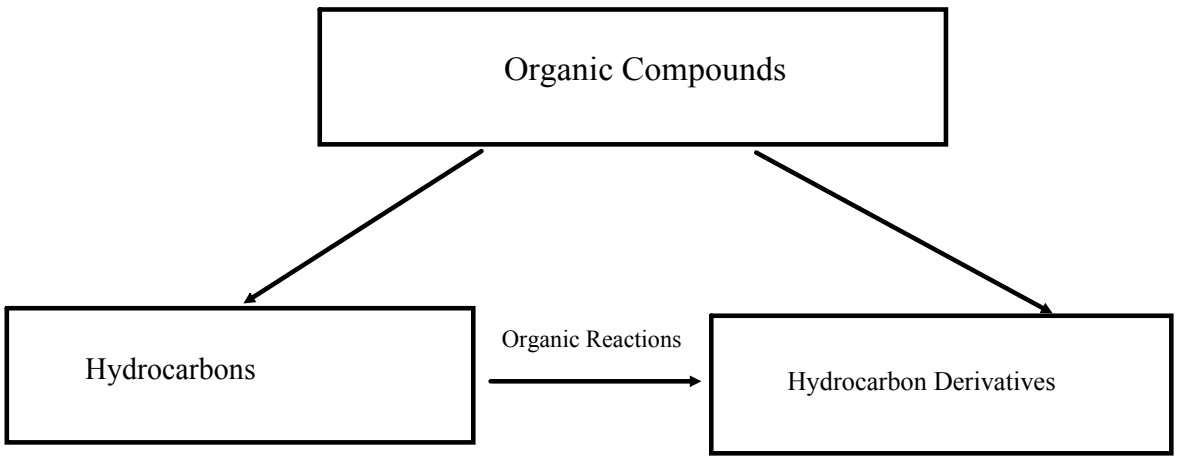
Organic compound with carbon atoms bonded **only to** hydrogen atoms

ex. C_3H_8 (only has C and H)

2. **Hydrocarbon derivatives**

Organic compounds with carbon atoms bonded to hydrogen and at least one other element

ex. CH_3Cl (has C, H and Cl)



Outcome 1 - Hydrocarbons

-We will be studying 4 families of Hydrocarbon compounds

- alkanes
- alkenes
- alkynes
- aromatics

- A family is a group of compounds that share a common characteristic

Part 1 - Alkanes (pg 366-372)

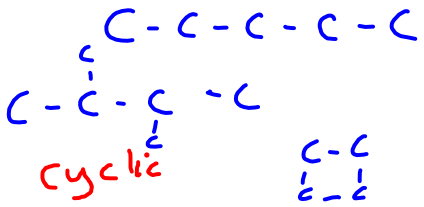
- (def) – hydrocarbons that have only **single bonds** linking the carbon atoms

- are also classified as ***saturated*** hydrocarbons

  - This means that each carbon has the maximum number of hydrogen atoms bonded to it

- can form 3 different types of structures

  - Strait chain alkanes – contain no branches
  - Branches alkanes – contain branches
  - Cycloalkanes – form ring structures



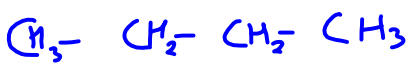
Straight chain alkanes (pgs 366-367)

- The name of each alkane starts with a prefix that tells us how many carbon atoms are found in the chain

- The names of alkanes end in –ane

- Examples:

butane



hexane

Prefixes for # of carbons

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

Branched alkanes (pgs 367-370)

- Alkanes can also have branches off of the main compound

- The branches must now become part of the compounds name

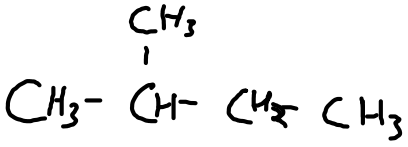
- Branches are called alkyl groups. Prefixes are similar but end in –yl.

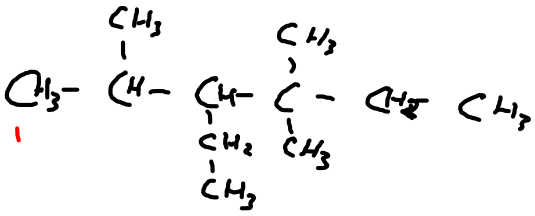
  - Example: a branch consisting of one carbon atom is called an **meth**yl group

SUMMARY ***Naming Branched Alkanes***

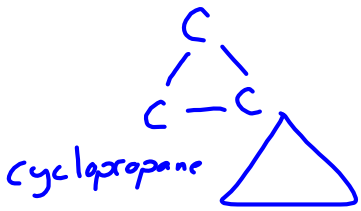
Step 1: Identify the longest continuous chain of carbon atoms—the parent chain—in the structural formula. Number the carbon atoms, starting from the end closest to the branch(es), so that the numbers are the lowest possible.
Step 2: Identify any branches and their location number on the parent chain.
Step 3: Write the complete IUPAC name, following this format:
(number of location) – (branch name)(parent chain).

Examples:





Cycloalkanes (pgs 371-372)

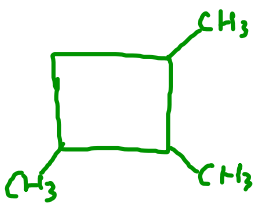


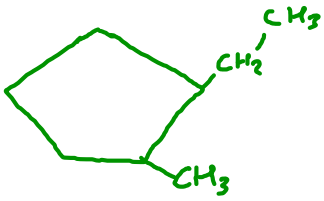
- An alkane which forms a cyclical shape or ring structure

- Name cycloalkanes by placing a *cyclo-* prefix in front of the alkane name (ex. Cyclopentane or cyclopropane)

- If there are branches, treat the ring structure as the parent chain and name the branches as before
  - Omit the 1 if only one branch is present

Examples:

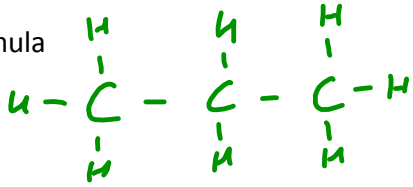




Types of Structural Formulas

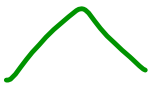
Chemical formula C_3H_8 - propane 2-methylpentane

Structural formula



Condensed structural formula

Line structural formula

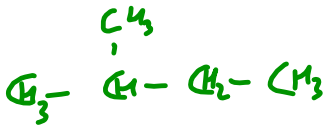


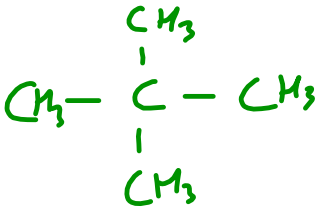
Structural Isomers

- Structural isomers are compounds that have the same molecular formula, but a different structure and name

Ex. C_5H_{12}

pentane methylbutane dimethylpropane

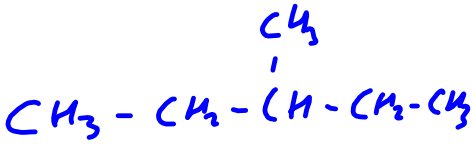




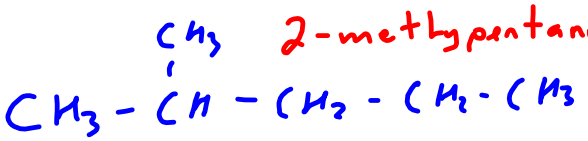
Ex. Draw the isomers of C_6H_{14}

hexane

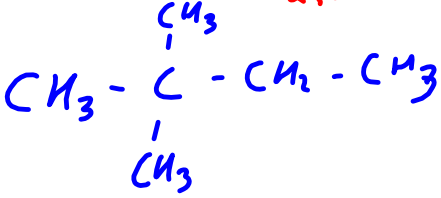
3-methylpentane

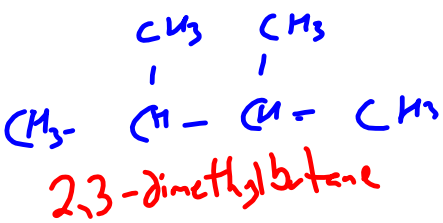


2-methylpentane



2,2-dimethylbutane



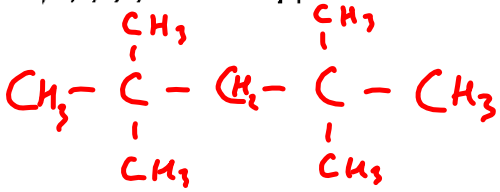


2,3-dimethylbutane

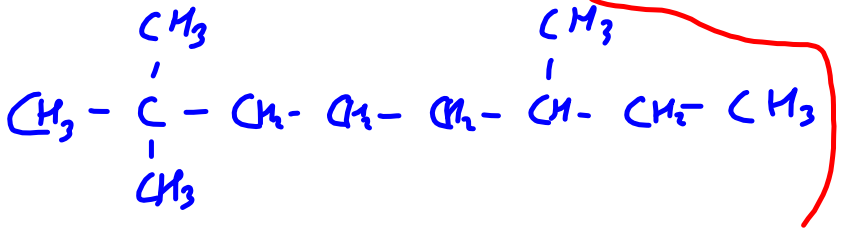
1. Write the condensed structural formula for the following:

a) 5-ethyl-2,8-dimethyldecane

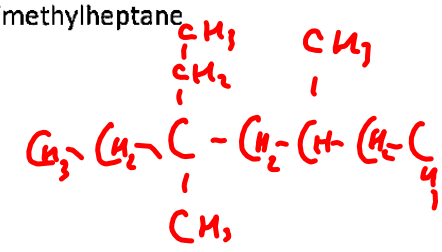
b) 2,2,4,4,-tetramethylpentane



c) 2,2,6-trimethyloctane



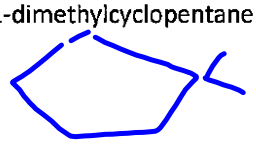
d) 3-ethyl-3,5-dimethylheptane



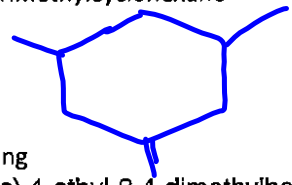
2. Draw the **line** formula for each of the following **cycloalkanes:**

a) ethylcyclobutane

b) 1,1-dimethylcyclopentane

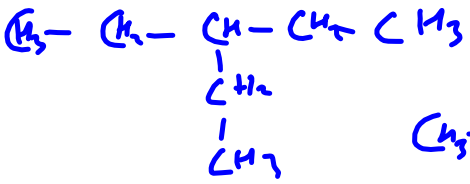


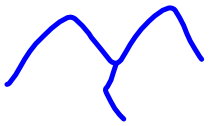
c) 1,3,5-trimethylcyclohexane



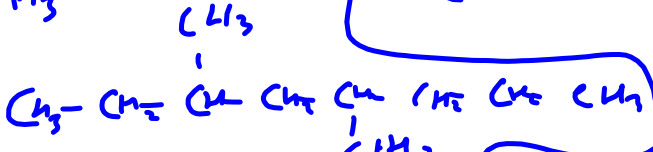
3. Draw a condensed structural diagram and a line diagram for each of the following

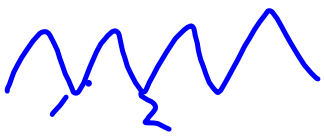
(a) 3-ethylpentane



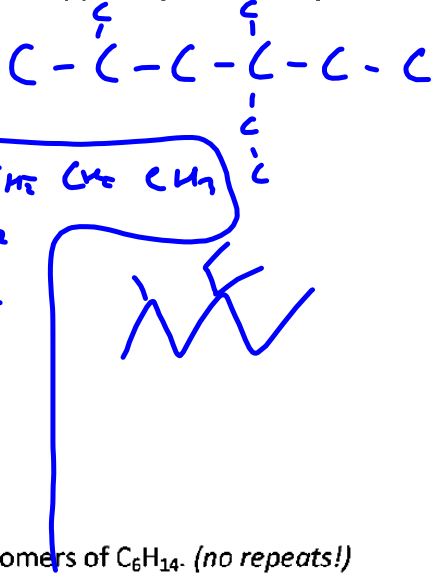


(b) 3-methyl-5-propyloctane





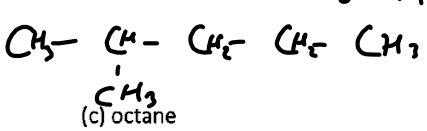
(c) 4-ethyl-2,4-dimethylhexane



3. Write all of the structural formulas **and** IUPAC names for all the isomers of C_6H_{14}. *(no repeats!)*

4. For each of the following IUPAC names, draw a condensed structural diagram (except cyclos) and a line diagr

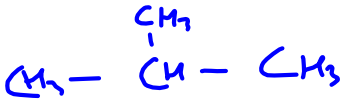
(a) 2 - methylpentane C_6H_{14}



(b) propane

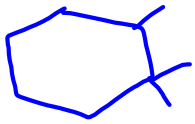
(c) octane

(d) methylpropane



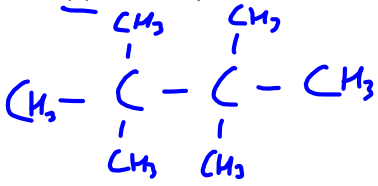
(e) 2,3,4-trimethylpentane

(f) 1,2,2 – trimethylcyclohexane



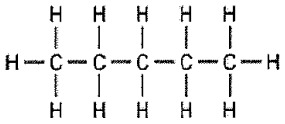
(g) ethane

(h) tetramethylbutane



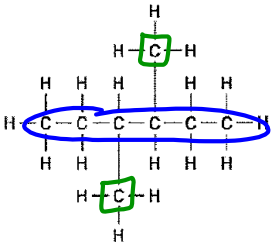
5. Name the following alkanes and draw line diagrams for each

a.



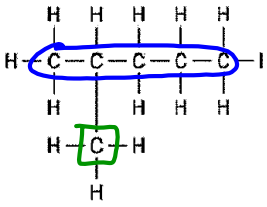
pentane

b.

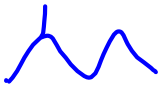


3,4-dimethylhexane

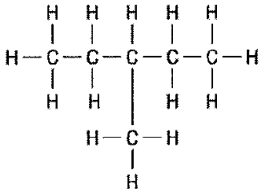
c.



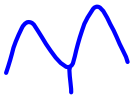
2-methylpentane



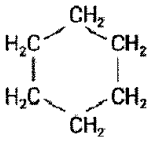
d.



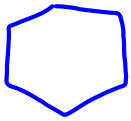
3-methylpentane



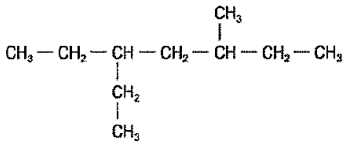
e.



cyclohexane



f.



3-ethyl-5-methylheptane