

Organic Compounds

Contain carbon atoms usually bonded to other carbon atoms and hydrogen atoms.

· Organic compounds may also contain: halogens, nitrogen, oxygen, phospharus,



- > Scientists thought that organic compounds contained a "life force" or "vitality."
- > Was proved incorrect in 1828 when an inorganic salt was heated to produce an organic compound.

$$H_4N - O - C \equiv N \xrightarrow{heat} H_2N - C - NH_2$$

ammonium cyanate urea

Inorganic Carbon Compounds

• Even if a compound contains carbon, it may not be classified as an organic compound.

* Compounds with other non-metals (besides H, N, O, S, P, and Hologens * Compounds with metals

Simple Hydrocarbons

- Recall that a carbon has <u>4</u> valence electrons.
- Each carbon atom can form <u>H</u> covalent bonds.
- With so many different ways that a carbon can bond...
 - There are
 <u>millions</u> of known organic compounds
 - There is an almost INFINITE # of unknown organic compounds

Alkanes

- Hydrocarbons containing only SINGLE bands.
- They are saturated there is no room for other atoms to bond to the carbon skeleton.
- Chemical Formula:

# of C Atoms	Prefix	Alkane
1	Ellin Meth-	Methane
2	Eth-	Ethanc
3	Prop-	Propane
4	But-	Butanc
5	Pent-	Pertane
6	Hex-	Hexane
7	Hept-	Hestare
8	Went at-	Octane
9	Non-	Nonane
10	Dec-	Decane

Problem Set:

1. Write out the condensed structural formula for all 10 straight-chain alkanes.

CH4 (CH3CH2CH2CH3 CH3CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2C
CH3CH3 (CH2CH CH
CH3CH2CH3	CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2CH2C
CH3 CH2 CH2 CH3	CH3CH2CH3CH3CH3CH3CH3CH3CH3

2. Draw the carbon skeleton formula for all 10 straight-chain alkanes. (You cannot draw methane.)

- 3. Draw a structural formula, condensed structural formula, and carbon skeletal formula for C₆H₁₄.

CH2CH2CH2CH2CH2CH2

4. Octane, a constituent of gasoline, has the molecular formula C₈H₁₈. Draw a structural formula, condensed structural formula and carbon skeleton formula for octane. Assume that the carbons are all bonded in a single chain to each other.



- 5. What would the formula be for a straight chain alkane that had the following number of carbon or hydrogen atoms?
 - a. 6 carbon atoms Co Hiy
 - b. 12 carbon atoms $-C_{12}$ H₂₆
 - c. 14 carbon atoms C14 Hzo
 - d. 29 carbon atoms C29 H60
 - e. 98 carbon atoms Cas Higs

- f. 102 hydrogen atoms C102 H 204
- g. 54 hydrogen atoms C54 Hillo
- h. 84 hydrogen atoms Can Hizo
- i. 16 hydrogen atoms Cu H34
- j. 4 hydrogen atoms C4 H10



3. Name each branch.

Give a prefix according to the number of carbon atoms it contains. Branch names end in 🚽 instead of

Anc.

$$CH_3 - CH - CH_2 - CH_3$$

 CH_3
List the branches in alphabetical order. If more than one branch has the same number of carbon
atoms use the prefixes di(2), tri(3) and tetra(4)

4. Name each branch.

State the name of the alkane by naming each branch, then naming the parent. Use commas between

numbers and hyphens between numbers and branches.

Practice #1.







Date:

Alkenes

- Hydrocarbons containing double bonds.
- General Formula: <u>C_H</u>
- They are unsaturated the double bond is a <u>reative site</u> for other atoms to bond to the carbon atom.

# of C Atoms	Prefix	Alkene
2	Eth-	Ethene
3	Prop-	Properce
4	But-	Butene
5	Pent-	Pentene
6	Hex-	Hexene
7	Hept-	Heptene
8	oct-	octene
9	Non-	Nonene
10	Dec-	Decene

Steps to Naming Alkenes:

5. The percent chain must contain the double bond. (even if it is not the longest chain)

H₃C - CH₂ C = CH₂ The longest continuous chain of carbon atoms including the double bond contains <u>5</u> carbon atoms

6. The parent chain carbon atoms are numbered Starting at the end closest to the double bond



The double bond follows carbon #_1_. The parent chain is called <u>here tere</u>. 7. The position of the double bond is indicated in the name by stating the <u>number</u> of the carbon atom in the parent chain that the double bond follows.



Alkynes

- Hydrocarbons containing triple bonds. •
- General Formula: Co Han-2 •

Steps to Naming Alkynes:

- The same rules for naming an alkene apply; however the ending is "_____ instead of
 - ene !

# of C Atoms	Prefix	Alkyne
2	Eth-	Etnune
3	Prop-	Propune
4	But-	Butune
5	Pent-	Peature
6	Hex-	Hexune
7	Hept-	Heatune
8	Oct-	ature
9	Non-	Nonme
10	Pec-	Decyne

Practice #1.

4.

Practice #2.

1. Parent Chain.

Pentyne

- 2. Number the parent chain.
- 3. Name the branches.
- Name the compound propyine 1. Parent Chain.

- 2. Number the parent chain.
- Name the branches. 3.

4.

Name the compound 3= ethyl-4-methyl-1-hexyne

 $CH = C - CH - CH_{3}$ $H = CH_{3} - CH_{2} - CH_{2} - CH_{3}$ $CH_{3} - CH_{2} - CH_{3} - CH_{3}$



Name:

Date:

· Carbon atoms may bond to each other and form a cyclic structure



Becomes...

Structural Formula

(b)

skeleton structure

Steps to Naming Cyclic Structures:

- The ring that contains the greater number of carbon atoms is the parent chain
- The prefix "______" is placed before the parent chain name.
- · Parent Chain = cycloheptanc



- The carbon atoms are numbered either clockwise or comterclockwise
- The LOWEST and bers are used to identify the placement of the branches.



3. Name the branches.



H₃C



4. Name the compound.



If the ring structure is not the longest continuous carbon chain, then it is named as a branch with prefix "cyclo" and ends in "yl."



Practice #2

- 1. Parent Chain. cyclopentane
- 2. Number the parent chain.
- Name the branches. 3.
 - methyl, propyl
 - Name the compound 1, 1-dimetry 1-3-propy leyclopertane

Practice #3

4.

- 1. Parent Chain
- Pertan
- Number the parent chain. 2.
- Name the branches. 3. cyclopropy



Aromatic Hydrocarbons

- Benzene is a hydrocarbon with Six carbon atoms in a ring. •
- It has the molecular formula ______ ٠
- There is _______ than one way of drawing its Lewis structure. •
- Equivalent Lewis structures are called <u>resonance</u> structures. •







• Some organic compounds have benzene as a branch. In this case, the branch name is

	"_phany]"
	Practice #4
1.	Parent Chain. Benzere
2.	Number the parent chain. CH ₃ -CH ₂
3.	Name the branches. CH ₃
4.	Name the compound 1. 4 - dietry 1-2-methylbenzene
	Practice #5 5_6
1.	Parent Chain. Hexone
2.	Number the parent chain.
3.	Name the branches.
4.	Name the compound 2 - phenyl-hexarc
	Practice #6
1.	Parent Chain. Ethere
2.	Number the parent chain.
3.	Name the branches. Phenyl
4.	Name the compound 1,2-diphenyl-1-ethere





- Structures that have the same molecular formula but different chemical properties
- As the number of <u>carbons</u> increases, the number of <u>isomers</u> increases.
- Pentane and 2-methylbutane are structural isomers. There is one more structural isomer. Can you find it?



Functional Groups

- An atom, group of atoms or type of bond in an organic molecule that react in a predictable manner.
- Symbol "R" is used to represent the <u>hydrocar bon</u> of the organic molecule

Alkyl Halide

x= F, CI, I, or Br Organic compounds containing halogens are called alkyl halides The prefixes are: F= fluro ci= chloro Br= bromo i= iodo

Practice #1.

1. Parent Chain. pentane L CH 3 CH

- Number the parent chain. 2.
- Name the branches. 3. chloro, Bromo
- Name the compound 4.

Practice #2.

3 1. Parent Chain. Benzene Number the parent chain. 2. CI Name the branches. chloro 3. 1-chlorobenzene Name the compound 4. **Alcohols: R-Oh**

4-bromo-2-chloropertone

Naming alcohols:

- 1. The parent chain must contain the atom attached to the -OH group. Number the carbon atoms in the parent chain so that the -OH group is given the lowest number.
- 2. The name of the parent chain ends with "-ol" instead of "-e".
- 3. Name and identify positions of the branches.
- 4. Name the compound.

Practice #1.

- 1. Parent Chain. chang
- Number the parent chain. 2.
- Name the branches. 3.
- 4. Name the compound







Practice #2.

Practice #3.

1. Parent Chain.

- 2. Number the parent chain.
- 3. Name the branches.
- 4. Name the compound



-metry 1-1-but no





Functional Groups II Name:

Date:



Aldehydes

Naming aldehydes:

- 1. Organic compounds containing an oxygen at the **END**... of a parent chain double bonded to a carbon.
- 2. To name aldehydes remove the "_____" from the end of the parent chain and replace it with
 " -

Practice #3.

- 1. Parent Chain. ethana
- 2. Number the parent chain.
- 3. Name the branches.
- 4. Name the compound

$H - \frac{c^{2}}{C} - C$

Practice #4.

1. Parent Chain.



- 2. Number the parent chain.
- 3. Name the branches. chloro
- 4. Name the compound

2-chloropentonal

-ethana



Ketones

Naming Ketones:

1. Organic compounds containing an oxygen in the MTDDLE of a parent chain double bonded to a carbon.

-butanone

2. To name ketones remove the "_____" from the end of the parent chain and replace it with

Practice #5.

**

1. Parent Chain.

- ONC

pentanone

- 2. Number the parent chain.
- 3. Name the branches.
- 4. Name the compound

pentonone

Practice #6.

1. Parent Chain.

nationer

- 2. Number the parent chain.
- 3. Name the branches.
- 4. Name the compound

3

5

Ethers

Naming Ethers:

1. Recognise that the molecule is an ether because it has the general form:

methoxu

propoxy

propoxypentane

etnoxy-2-methy propose

methoxy

- 2. Identify the ______ labelled "R1" and "R2". Standard system of labelling carbon chains as used for alkanes.
- 3. The shorter of the two chains "R₁" and "R₂" becomes the $\pm irs \pm$ of the name with the "OXY

suffix, and the name of the longer alkane chain forming the suffix of the name of the ether.

Practice #8.

- 1. Parent Chain. propane
- 2. Number the parent chain.
- 3. Name the branches.
- 4. Name the compound

Practice #9.

2.

- 1. Parent Chain.
 - Number the parent chain.

pentanc

- 3. Name the branches.
- 4. Name the compound

Practice #10.

5. Parent Chain.

propene

- 6. Number the parent chain.
- 7. Name the branches. etroxy, enethy
- 8. Name the compound







propane

Esters -+ Last one

on either side of the Okyaco

Naming Esters:

1. First, identify the ______ that is part of the continuous chain and bonded to carbon on both sides. (On one side of this ______ there will be a carbonyl present but on the other side there won't be.) oxygen in chain

- _ from the carbonyl] (space) [alkane on the ______ with 3. Next, use this format: [alkyl on side + the carbonyl] - (In this case: [methyl] [methane])
- to -oate 4. Finally, change the ending of the alkane on the same side as the carbonyl from _____ (In this case: methyl methanoate)

propylethenoate

Practice #11.

1. Parent Chain. ethonoate

2. Second, begin numbering the

- Number the parent chain. 2.
- Name the branches. propy 3.
- Name the compound 4.

Practice #12.

1. Parent Chain.

butanot

carbony

Carbon

- Number the parent chain. 2.
- Name the branches. ethu 3.
- Name the compound 4.

3

identified in step 1.



ethyl butonoate

Practice #13.

5. Parent Chain.

- 6. Number the parent chain.
- 7. Name the branches. penty, bromo, chloro
- 8. Name the compound



3-bromopenty 1-2-chloro buteroate