Organic Nomenclature

Representing Organic Molecules
Hydrocarbon Nomenclature
Functional Groups

What are organic molecules?

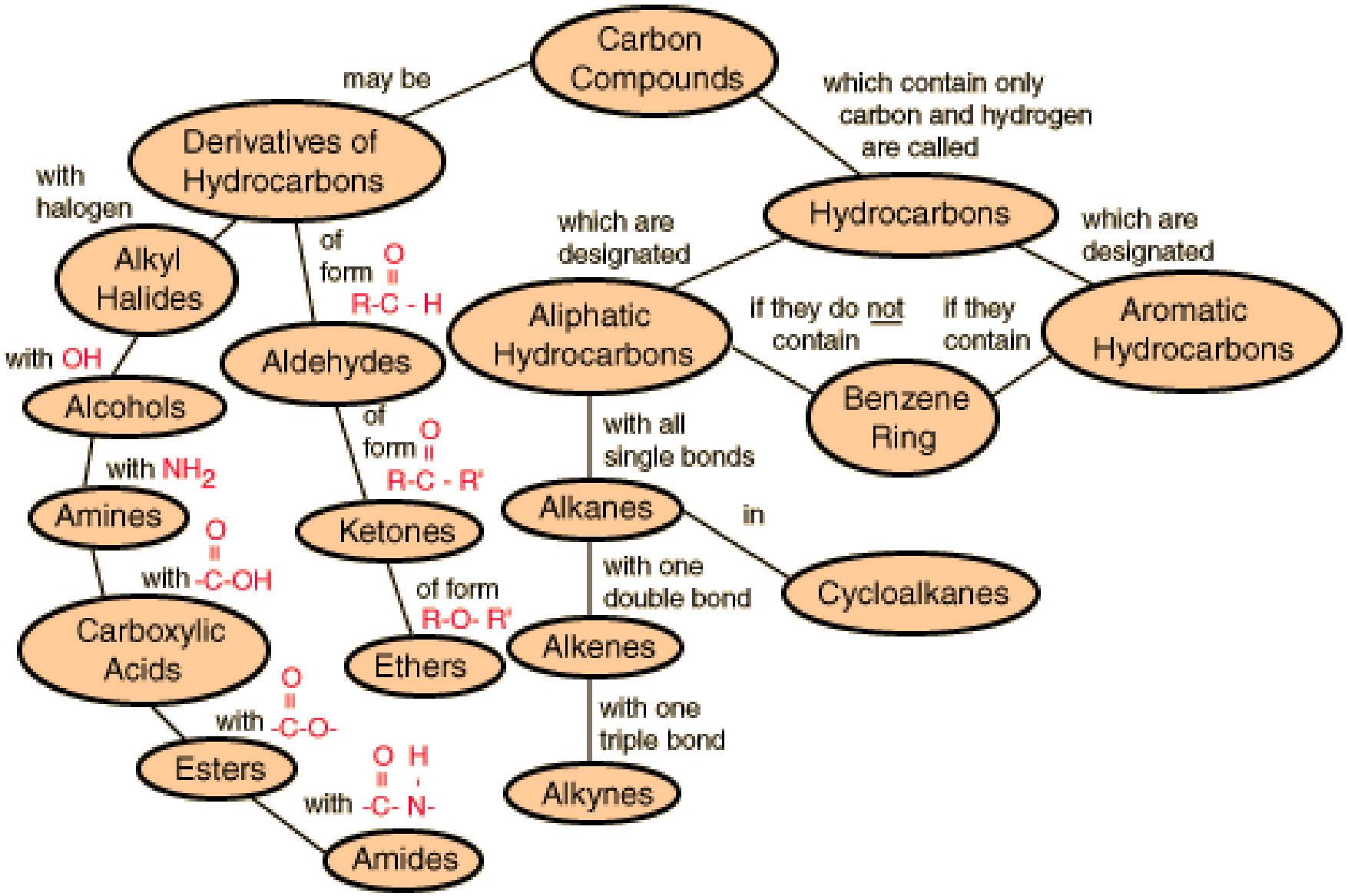
- Organic molecules are covalently-bonded molecules made up of carbons in chains or rings bonded with hydrogens
- One formula may give multiple different organic molecules, known as “isomers”
- Because of this, we don’t just write formulas for organic molecules

Why are there so many organic molecules?

1. Carbon has 4 valence electrons therefore 4 bonds.

2. Carbon readily bonds with other carbon atoms forming chains, branched or cyclic compounds.

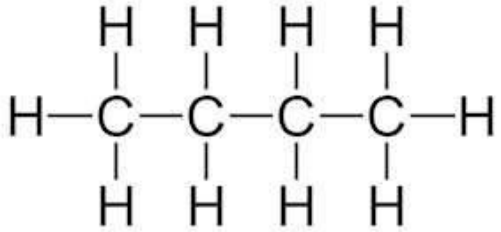
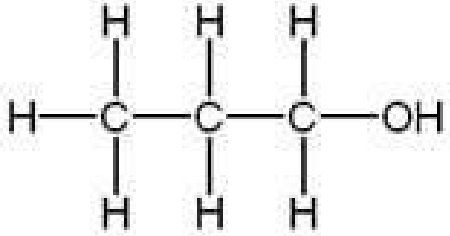
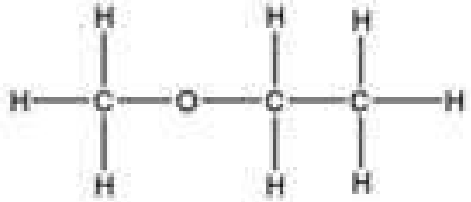
3. Carbon also readily bonds with other elements such as O, N, S, halogens.


Carbon Compounds
may be
Derivatives of Hydrocarbons
which contain only carbon and hydrogen are called
Hydrocarbons
with halogen
Alkyl Halides
of form O = R-C - H
Aldehydes
which are designated
Aliphatic Hydrocarbons
which are designated
Aromatic Hydrocarbons
If they do not contain
Benzene Ring
if they contain
with OH
Alcohols
with NH_2
Amines
of form O = R-C - R'
Ketones
with all single bonds
Alkanes
in
Cycloalkanes
O = with -C-OH
Carboxylic Acids
of form R-O- R'
Ethers
with one double bond
Alkenes
O = with -C-O-
Esters
with one triple bond
Alkynes
O H with -C- N-
Amides

Drawing Organic Compounds

There are 3 ways to draw an organic compound.

1. **Structural Diagram:** shows all bonds in the molecule. (the H's are generally left off to keep structures clean)
2. **Condensed Structure**: no bonds but all atoms are shown in sequence. (Must put bonds between C's in for cyclo's)
3. **Line (Skeletal) Diagram:** carbon atoms are implied by the vertices (including ends) in the structure, H's are not shown but any other atoms are written.

Structural	Condensed	Line
butane 	$CH_3CH_2CH_2CH_3$ or $CH_3(CH_2)_2CH_3$	
propan-1-ol 	$CH_3CH_2CH_2OH$ or $HOCH_2CH_2CH_3$	
methoxyethane 	$CH_3OCH_2CH_3$	

General Rules for Naming Organic Compounds

- the prefix indicates the number of carbon atoms.
- the ending indicates the functional groups in the structure (C=C “ene”, –OH “ol”).
- any branches are indicated before the prefix for the number of carbons in alphabetical order.
- below shows the order of different components in the name

BRANCHES # of C’s BONDS FUNCTIONAL GROUPS
in alpha order alpha alpha order
(highest priority always last)

General Naming Rules for Organics

- The prefix indicates the **number of carbon atoms** in the chain.

→

- The ending indicates the functional groups in the structure.

# of C's	prefix
1	meth
2	eth
3	prop
4	but
5	pent
6	hex
7	hept
8	oct
9	non
10	dec

Alkanes

- All C-C single bonds
- General Formula C_nH_{2n+2}, where “n” is the number of carbon atoms in the chain.

Naming

1. Use the correct prefix to indicate the number of carbons.
2. Ending is “ane”

Alkanes

Structure	Name
C-C	
C-C-C-C-C	
C-C-C	
C-C-C-C-C-C-C	

Naming Branched Hydrocarbons

1. Identify the longest continuous chain or ring of carbon atoms.
2. Number the carbons from the end that gives the lowest sum for the numbers of the branches.
3. Name each branch and indicate its location with a number.
4. List the branches in alpha order before the prefix for the number of carbons.
5. Commas separate numbers and hyphens separate numbers from words.
6. If there is more than 1 of the same branch Greek prefixes are used to indicate this but the prefix is not counted in determining alpha order.

Naming Hydrocarbon (Alkyl) Branches

- Not all alkyl branches will be attached to the main chain at carbon 1.
- When carbon 1 of the branch is attached to the main chain (R) the branch is named using the prefix for the # of C's with "yl" attached.

Examples:

propyl R--CH_2—CH_2—CH_3

pentyl R—CH_2—CH_2—CH_2—CH_2—CH_3

Naming Hydrocarbon (Alkyl) Branches

- When it is not attached at carbon 1, you must indicate to which carbon it is attached

Examples:

propan-2-yl

pentan-3-yl

Other branches, for example:

- Halogen branches, such as:
  --Br bromo --I iodo
  --Cl chloro --F fluoro

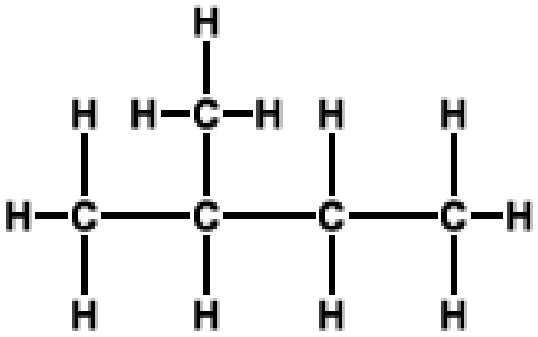
- Nitro, --NO_2

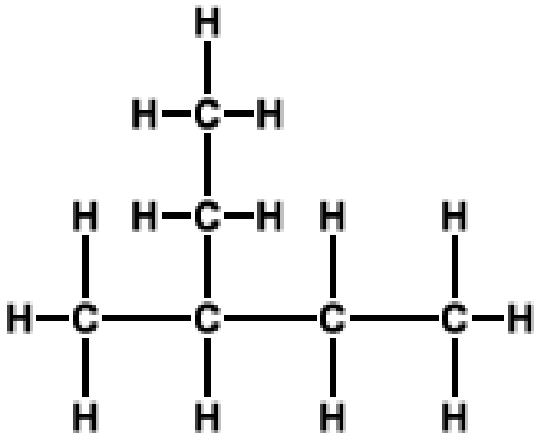
- Amino, --NH_2

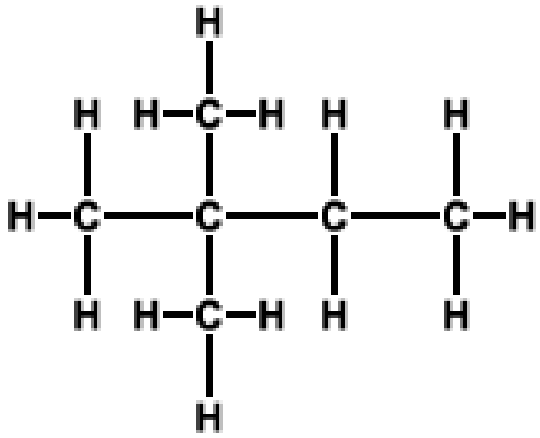
- Hydroxy, --OH

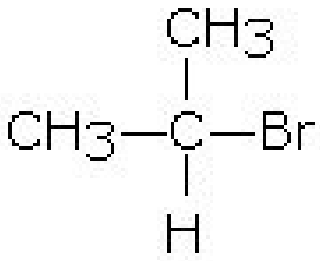
Examples:

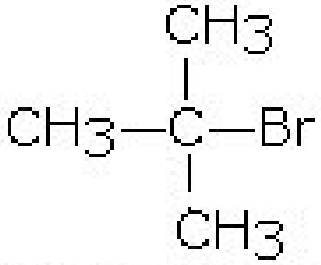
Name the following:











Alkenes

- Contain 1 or more C=C double bond.
- When naming use the suffix “ene”.
- The position of the double bond is indicated for simple alkenes with 4 or more carbons or for all branched alkenes.
- The position of the double bond is indicated with a number in front of the “ene”
- If it has *cis* or *trans* configuration, that would be indicated before the number

Example: hex-*cis*-2-*trans*-4-diene has 2 double bonds, one in the *cis* formation at carbon 2 and one in the *trans* formation at carbon 4

Alkynes

- Contain at least 1 C≡C bond.
- When naming use the suffix “yne”.
- The position of the triple bond is indicated for simple alkynes with 4 or more carbons or for all branched alkynes.
- The position of the triple bond is indicated with a number in front of the “yne”

Naming Cyclos

1. Find the longest continuous ring.
2. Add “cyclo” in front of the prefix for the number of carbons. i.e. “cyclopent”
3. Number the ring to give you the lowest sum of all the numbers. You can start anywhere and go clockwise or counter clockwise.
4. If there is only 1 thing on the ring, NO NUMBER is used. (e.g. methylcyclopentane not 1-methylcyclopentane)