

ORGANIC CHEMISTRY

Hydrocarbon Compounds

5 CLASSES:

ALKANES, ALKENES, ALKYNES, CYCLIC, AND AROMATIC

ALKANES

- Only contain a single covalent bond

Ex. Methane-----decane

To write the molecular formula:

Count the # of C and count the # of H

Ex. Butane – C₄H₁₀

To write the structural formula:

A. Complete formula showing all bonds

1. Condensed formula

- C-H bonds understood
- * C-H bonds and C-C bonds understood
- All bonds understood and () used to indicate CH₂ units linked together continuously.
- Carbon skeleton

BRANCHED-CHAIN ALKANES

- Alkanes with 1 or more alkyl (group of hydrocarbons) groups that are not in a continuous chain.

SUBSTITUENTS: Hydrogen atoms are not the only atoms that can bond to C. Other C, N, S, and P can bond.

NAMING BRANCHED-CHAINS:

1. Find the longest continuous chain (up, down, left, or right...). This is the "parent" hydrocarbon structure
1. # of C in main chain sequence: Start at the end with the *smallest* numbers
2. Add numbers to the names of the substituent groups to ID their positions on the chain.
3. Use prefixes to indicate the # of identical alkyl groups. ex. dimethyl
4. List the names of alkyl substituents in alphabetical order. IGNORE prefixes...
5. Use proper punctuation; Commas to separate #'s and hyphens to separate #'s and words. The name of the alkane is written as one word.

CONSTRUCTING STRUCTURAL FORMULAS:

1. Find the root word (-ane) and write the longest C chain.
2. # the C's on this parent chain.
3. ID the substituent groups and attach at the proper positions.
4. Add H as needed.

2, 2, 4-trimethylpentane

PROPERTIES OF ALKANES

- not attracted to water because of the hydrocarbon's nonpolarity
- weak van der Waals forces hold the C-C and the C-H together
- solutions of alkanes will dissolve in nonpolar substances, but NOT polar ones
- structural isomers: differ in B.P. and M.P. and different reactivities (highly branched – the lower the B.P.)

ALKENES

-Organic compounds with C-C double bonds

These bonds are *unsaturated* because they contain fewer than max # of H in their structure.

Therefore, alkanes would be _____.

NAMING ALKENES:

- rules as alkanes, but the ending is –ene.
- The chain is also numbered so that the C atoms of the double bond get the lowest number.

ALKYNES

Organic compounds with triple bonds between C-C atoms.
They are also unsaturated compounds.

Naming and writing structural formulas are the same as alkenes, except the ending of the chain is –yne.

GEOMETRIC ISOMERS (cis and trans)
STEREoisomers

CYCLIC HYDROCARBONS

- compounds that contain a hydrocarbon ring
- rings can contain 3-20 Carbons (naturally)
- 5 and 6 ringed structure are most abundant
- aliphatic compounds don't contain rings, but include both short and long C chains.

ARENES: Unsaturated cyclic hydrocarbons that contain single rings or groups of rings. (BENZENE)

AROMATIC COMPOUNDS

Any substance that has bonding like benzene.

-resonance is exhibited by the benzene ring, making benzene not as reactive as 6 – C chains. It makes benzene flat and no bending or twisting can take place.

- compounds containing substituents attached to the benzene ring are derivatives of benzene. If benzene is a substituent on an alkane, it is a phenyl group.

3-phenylhexane

Disubstituted benzenes: derivatives of benzene that have 2 substituents.

Ortho- 1, 2

Meta- 1, 3

Para- 1,4

Natural Hydrocarbons

1. Coal: peat-lignite-bituminous-anthracite
1. Natural Gas
3. Petroleum