Chemistry 11

Organic Chemistry I

Name:
Date:
Block:

1. **Carbon – Organic Compounds**
2. **Simple Hydrocarbons**
3. **Naming Simple Hydrocarbons**

Carbon – Organic Compounds

Lewis Structure for Carbon:

Carbon has 6e⁻
2e⁻ on 1st shell
4e⁻ on 2nd shell

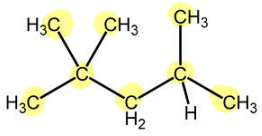
A carbon atom has 4 valence electrons.

Organic Compounds

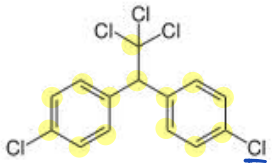
- Compounds that contain Carbon atoms usually bonded to other carbon atoms and hydrogen atoms
  - Called hydrocarbons
- Organic compounds may also contain halogens, nitrogen, oxygen, phosphorus, sulphur

Examples of organic compounds:

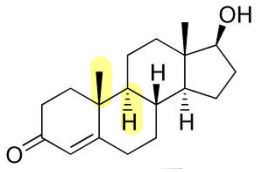
1. gasoline



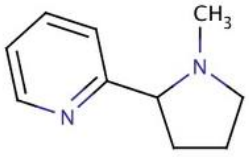
2. DDT (insecticide)



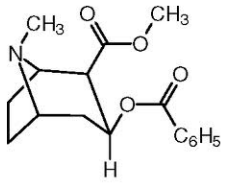
3. Testosterone



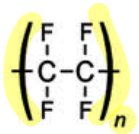
4. Nicotine



5. Cocaine



6. Teflon



Inorganic Carbon Compounds

- Even if a compound contains carbon, it may not be classified as an organic compound
  - ❖ Compounds w/ other nonmetals (ex. CO)
  - ❖ Compounds w/ other metals (ex. TiC)
  - ❖ Compounds containing the CN^- group (ex. HCN)

Simple Hydrocarbons

- Recall that a carbon has 4 valence electrons.
- Each carbon atom can form 4 covalent bonds.

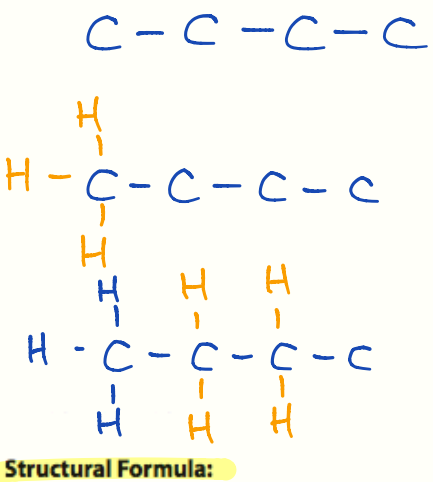
Sample Problem — Using Structural Formulas to Represent Organic Compounds

Butane is a fuel used in lighters. It has the formula C_4H_{10} and has four carbon atoms attached to each other in a chain with only single bonds. Draw a structural formula for butane.

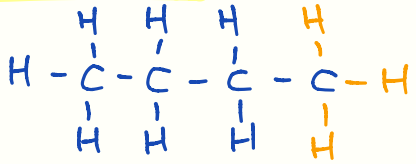
What to Think about

1. The four carbon atoms are bonded to each other in a chain, so draw four carbon atoms attached to one another in a line.
2. Each carbon atom can form four covalent bonds. The first carbon atom has one bond to the carbon atom beside it. It can therefore bond with three hydrogen atoms.
3. The next two carbon atoms have two other carbon atoms already covalently bonded to them. They can only bond with two hydrogen atoms each.
4. The last carbon atom is already bonded to one other carbon atom. It can form three bonds with hydrogen. The formula shown on the right is called a structural formulas.
5. Condense this structural formula by writing the number of hydrogen atoms bonded to each carbon.
6. To condense this formula even more, use a line to represent each carbon bond. Do not show the carbon or hydrogen atoms at all. Notice that the lines will not be attached in a straight line. Organic molecules are not linear. At the end of each line segment is a carbon atom not shown. Hydrogen atoms are also not shown in this formula.

How to Do It



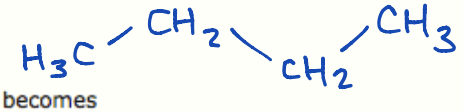
Structural Formula:



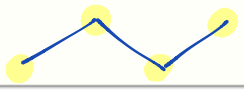
Condensed Structural Formula:

$CH_3-CH_2-CH_2-CH_3$

Carbon Skeleton Formula:



becomes



Naming Simple Hydrocarbons

- Alkanes are hydrocarbons containing single bonds
- They are saturated – there is no room for other atoms to bond to the carbon skeleton.
- Chemical Formula: C_nH_{2n+2}

# of C Atoms	Prefix	Alkane	Formula
1	meth –	methane	CH_4
2	eth –	ethane	C_2H_6
3	prop –	propane	C_3H_8
4	but –	butane	C_4H_{10}
5	pent –	pentane	C_5H_{12}
6	hex –	hexane	C_6H_{14}
7	hept –	heptane	C_7H_{16}
8	oct –	octane	C_8H_{18}
9	non –	nonane	C_9H_{20}
10	dec –	decane	$C_{10}H_{22}$

Practice!

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

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

3. Octane, a constituent of gasoline, has the molecular formula C_8H_{18}. 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.

4. Draw a structural formula, condensed structural formula, and carbon skeletal formula for C_6H_{12}. Arrange the carbon atoms in a closed ring shape so that each carbon atom is bonded to two other carbon atoms.

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

   b. 12 carbon atoms

   c. 14 carbon atoms

   d. 29 carbon atoms

   e. 98 carbon atoms

   f. 102 hydrogen atoms

   g. 54 hydrogen atoms

   h. 84 hydrogen atoms

   i. 16 hydrogen atoms

   j. 4 hydrogen atoms