

Lect.10.Organic Chemistry .10.1 What is organic chemistry

Organic chemistry is the study of compounds that contain the element carbon.

Clothes, foods, medicines, gasoline, refrigerants, and soaps are composed almost solely of organic compounds.

By studying the principles and concepts of organic chemistry, you can learn more about compounds present in these substances and how they affect the world around you.

Figure :1 Some Common Products of Organic Chemistry Used in Medicine

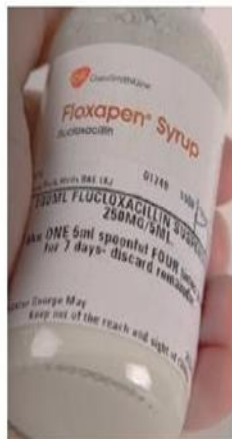
a. Oral contraceptives



b. Plastic syringes



c. Antibiotics



d. Synthetic heart valves



- Organic chemistry has given us contraceptives, plastics, antibiotics, synthetic heart valves, and a myriad of other materials. Our lives would be vastly different today without these products of organic chemistry.



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**Organic compounds exist as discrete molecules with much weaker intermolecular forces-the forces that exist between molecules-than those seen in ionic compounds, which are held together by very strong interactions of oppositely charged ions.**

**As a result, organic compounds resemble other covalent compounds in that they have much lower melting points and boiling points than ionic compounds. While ionic compounds are generally solids at room temperature, many organic compounds are liquids and some are even gases.**

**Table 1: compares these and other properties of a typical organic compound (butane,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ ) and a typical (ionic inorganic compound (sodium chloride,  $\text{NaCl}$ ).**

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**Lect.10.****Table 1 compared between organic and inorganic compounds**

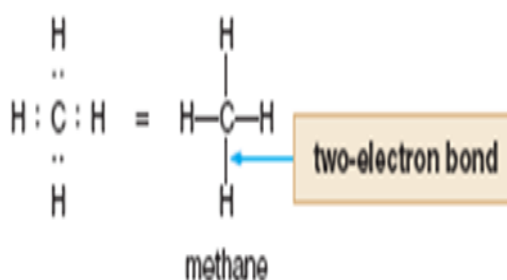
Organic Compounds	Inorganic Compounds
Bonding is almost entirely covalent.	Most have ionic bonds.
Many are gases, liquids, or solids with low melting points (less than 360°C).	Most are solids with high melting points.
Most are insoluble in water.	Many are soluble in water.
Most are soluble in organic solvents such as diethyl ether, toluene, and dichloromethane.	Almost all are insoluble in organic solvents.
Aqueous solutions do not conduct electricity.	Aqueous solutions form ions that conduct electricity.
Almost all burn and decompose.	Very few burn.
Reactions are usually slow.	Reactions are often very fast.

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Lect.10.10.2 Characteristic Features of Organic Compounds.

[1] All organic compounds contain carbon atoms and most contain hydrogen atoms.

Carbon always forms four covalent bonds, and hydrogen forms one covalent bond.

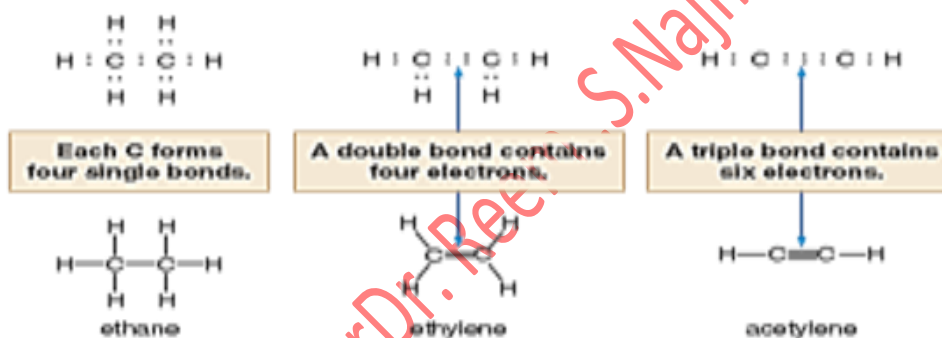


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[2]Carbon forms single, double, and, triple bonds to other carbon atoms.

When a compound contains two or more carbon atoms, the type of bonding is determined by the number of atoms around carbon. Consider the three compounds drawn below.

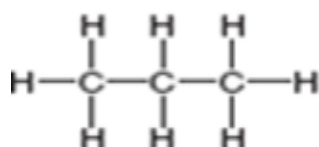


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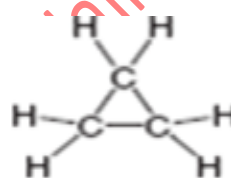
[3]some compounds have chains of atoms and some compounds have rings.

For example, three carbon atoms can bond in a row to form propane, or form a ring called cyclopropane.

Propane is the fuel burned in gas grills, and cyclopropane is an anesthetic.



propane  
 $\text{C}_3\text{H}_8$



cyclopropane  
 $\text{C}_3\text{H}_6$

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**[4]Organic compounds may also contain elements other than carbon and hydrogen.**

**Any atom that is not carbon or hydrogen is called a heteroatom.**

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10.2 Functional Groups

In addition to strong C-C and C-H bonds, organic molecules may have other structural features as well.

Although over 20 million organic compounds are currently known, only a limited number of common structural features, **called functional groups**, are found in these molecules.

**A functional group is an atom or a group of atoms with characteristic chemical and physical properties.**

A functional group contains a heteroatom, a multiple bond, or sometimes both a heteroatom and a multiple bond.

A functional group determines a molecule's shape, properties, and the type of reactions it undergoes.

A functional group behaves the same whether it is bonded to a carbon backbone having as few as two or as many as 20 carbons.

For this reason, we often abbreviate the carbon and hydrogen portion of the molecule by a capital letter **R**, and draw the **R**, bonded to a particular functional group.







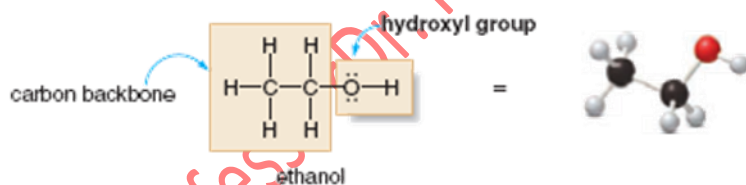
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Ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ ), for example has two carbons and five hydrogen's in its carbon backbone, as well as an OH group, a functional group called a hydroxyl group.

The hydroxyl group determines the physical properties of ethanol as well as the type of reactions it undergoes.

Moreover, any organic molecule containing a hydroxyl group has properties similar to ethanol.

Compounds that contain a hydroxyl group are called alcohols.



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The most common functional groups can be subdivided into three types.

### Hydrocarbons

Compounds containing a single bond to a heteroatom

Compounds containing a C O group.

### 10.3Hydrocarbons

Hydrocarbons are compounds that contain only the elements of carbon and hydrogen, as shown in below Table.

