University of Basrah
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# MEDICAL CHEMISTRY

# INTRODUCTION

BY

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# INTRODUCTION

Organic chemistry is the chemistry of carbon compounds. The element carbon has a special role in chemistry because it bonds with other carbon atoms to give a vast array of molecules.

**The chemistry of compounds containing C bonded to H.**

**⇒Also may contain O, N, S, and halogens**

***Reasons for large numbers of organic compounds:***

1. **Carbon atoms can form strong, stable bonds to other C atoms (thus forming rings, chains, etc.) and to atoms such as H, O, N, S, halogens. (small size)**

2. **Carbon atoms form up to 4 bonds simultaneously: (valence of 4) molecules can be branched.**

3. Carbon atoms form multiple bonds with C or with O, N, S: further structural variations are possible. (Small size and valence of 4)

4. The C-H bond is nonpolar, but bonds to other elements (N, O, halogens) are polar. (electronegativity)

# CLASSES OF ORGANIC COMPOUNDS

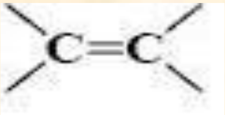
Classification is necessary to manage the large number of compounds

Classes of HYDROCARBONS:

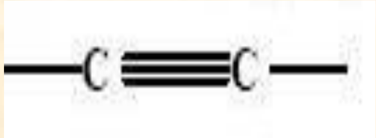
Contain only C and H (Simplest organic compounds)

1) alkanes all single bonds

2) alkenes one or more double bonds

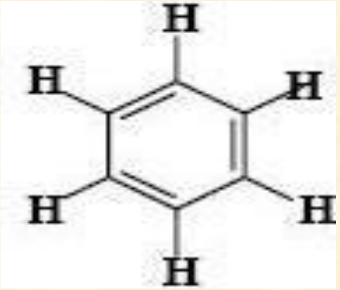


3) alkynes one or more triple bonds




4) aromatic alternating single and double Bonds in a ring

Example: benzene ring



# ADDITION REACTIONS

**C-C Double and triple bonds are reactive: addition reactions typically occur at room temperature.**

***For Alkenes***

*For Alkenes*

– $CH_3{-}CH{=}CH_2 + Br_2 \rightarrow$

or

– $CH_3{-}CH{=}CH{-}CH_3 + HX \rightarrow$

- where $X$ = Cl, Br, I, OH, etc.

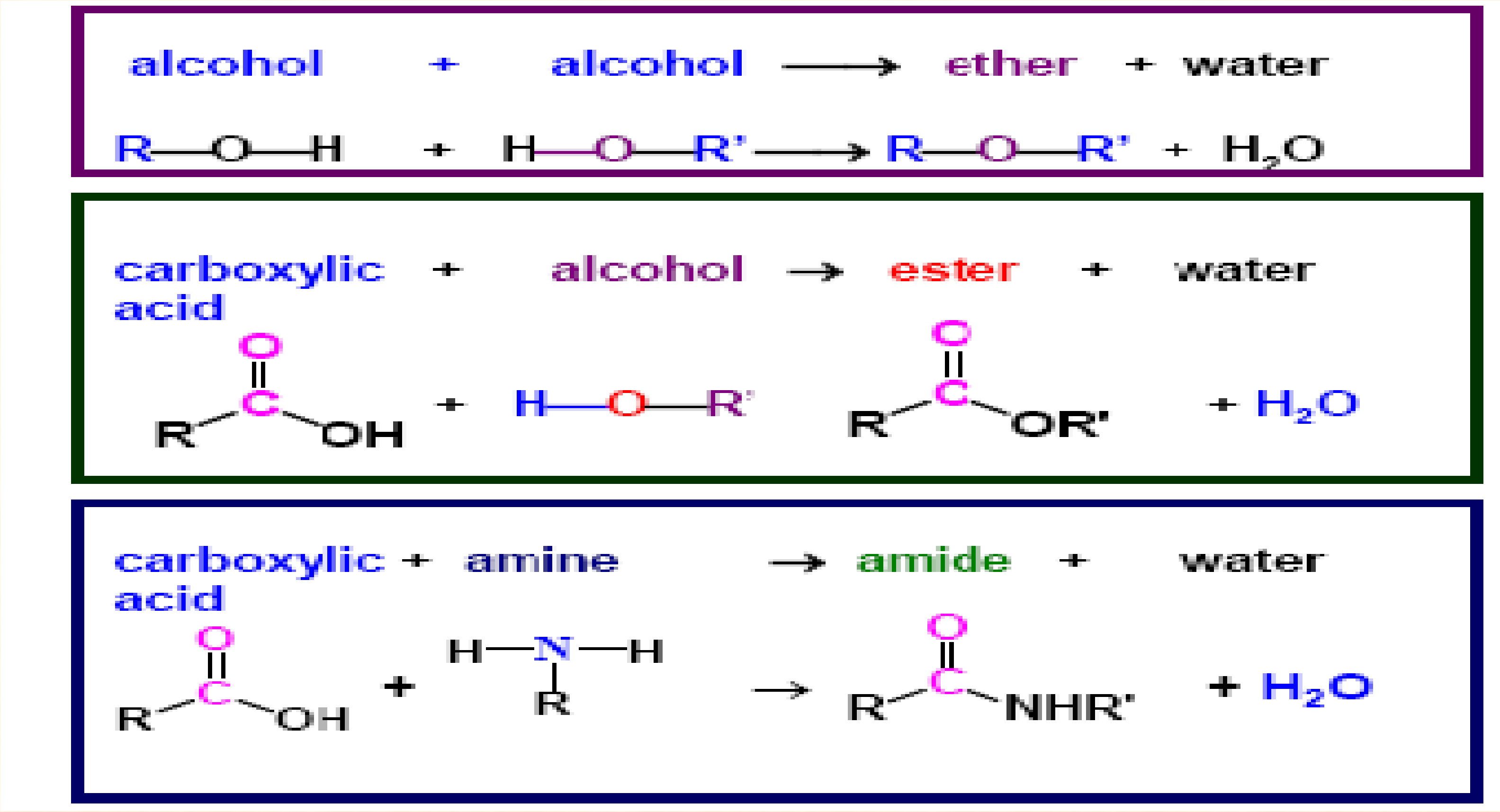
*For Alkynes*

$CH_3{-}C{\equiv}CH + 2\,Br_2 \rightarrow$

$CH_3{-}C \equiv C{-}CH_3 + 2HCl \rightarrow$

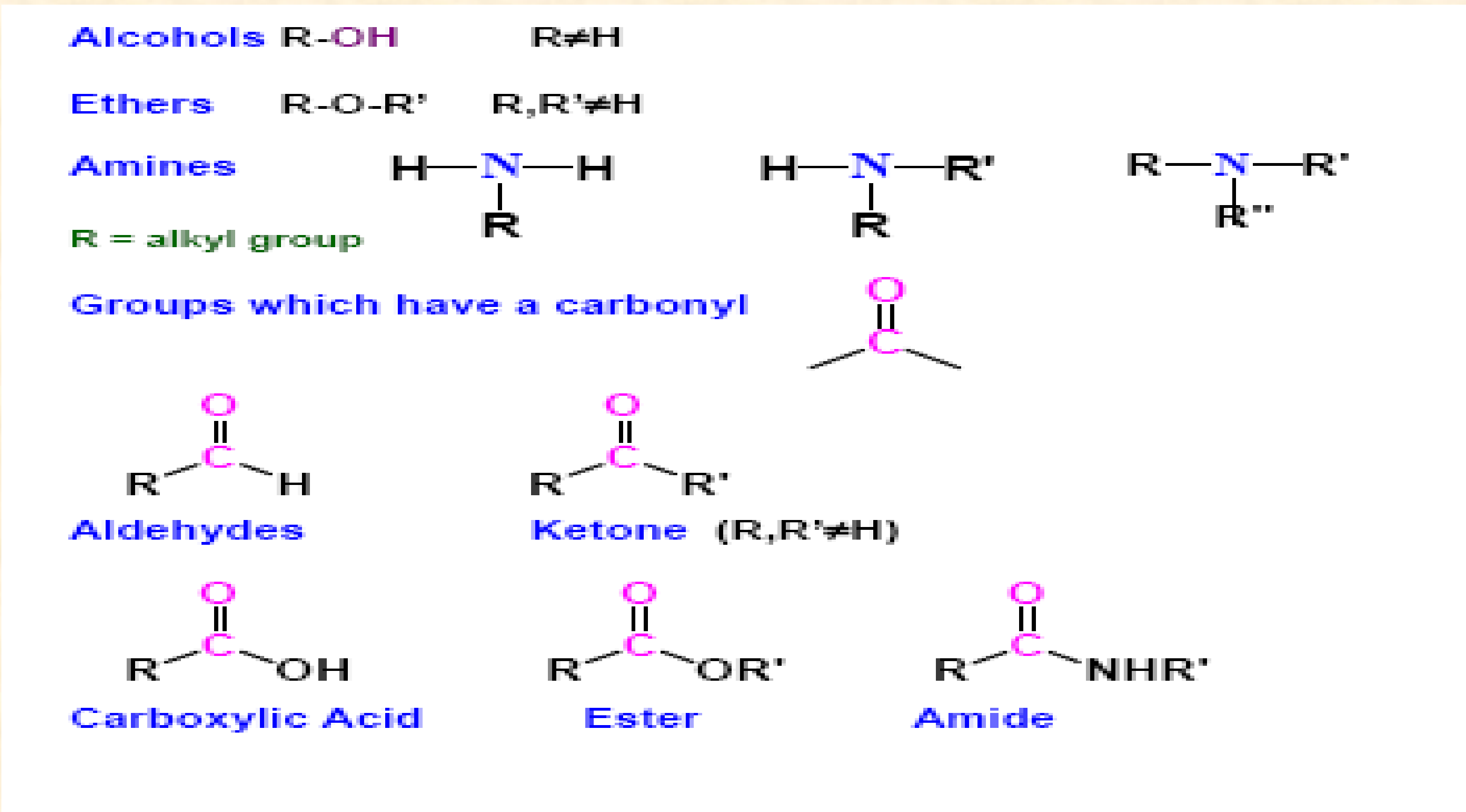
# CONDENSATION REACTIONS

Two molecules join by eliminating a small molecule (such as water) .Ethers, Esters, and Amides are formed via condensation reactions:



# FUNCTIONAL GROUP CLASSES

Contain a representative group of elements in a fixed pattern: Each class has similarities in structure and function (reactivity).



| Class | Functional Group | Example |
|---|---|---|
| Alkene | $>C=C<$ | $H_2C=CH_2$ |
| Alkyne | $-C\equiv C-$ | $HC\equiv CH$ |
| Haloalkane | $-F$, $-Cl$, $-Br$, $-I$ | $CH_3-Cl$ |
| Alcohol | $-OH$ | $CH_3-CH_2-OH$ |
| Ether | $-O-$ | $CH_3-O-CH_3$ |
| Aldehyde | $-C(=O)-H$ | $CH_3-C(=O)-H$ |
| Ketone | $-C(=O)-$ | $CH_3-C(=O)-CH_3$ |
| Carboxylic acid | $-C(=O)-O-H$ | $CH_3-C(=O)-O-H$ |
| Ester | $-C(=O)-O-$ | $CH_3-C(=O)-O-CH_3$ |
| Amine | $-N(-)-$ | $CH_3-NH_2$ |
| Amide | $-C(=O)-N(-)-$ | $CH_3-C(=O)-NH_2$ |

# POLARITY OF ORGANIC MOLECULES

A covalent bond between two carbon atoms is non polar because the electrons are shared equally. However , when a carbon atom bonds to a different atom, the bond is polar covalent. Most of the elements found in organic compounds are more electronegative than carbon. with the exception of hydrogen.

| Element | F | O | N | Cl | Br | C | H |
|---|---|---|---|---|---|---|---|
| Electronegativity value | 4 | 3.5 | 3 | 3 | 2.8 | 2.5 | 2.1 |

**As the carbon bonds to atoms with higher electronegativity values, the polarity of the bonds increase .**

$H_3C-C_3H$ $H_3C-Br$ $H_3C-NH_2$ $H_3C-OH$

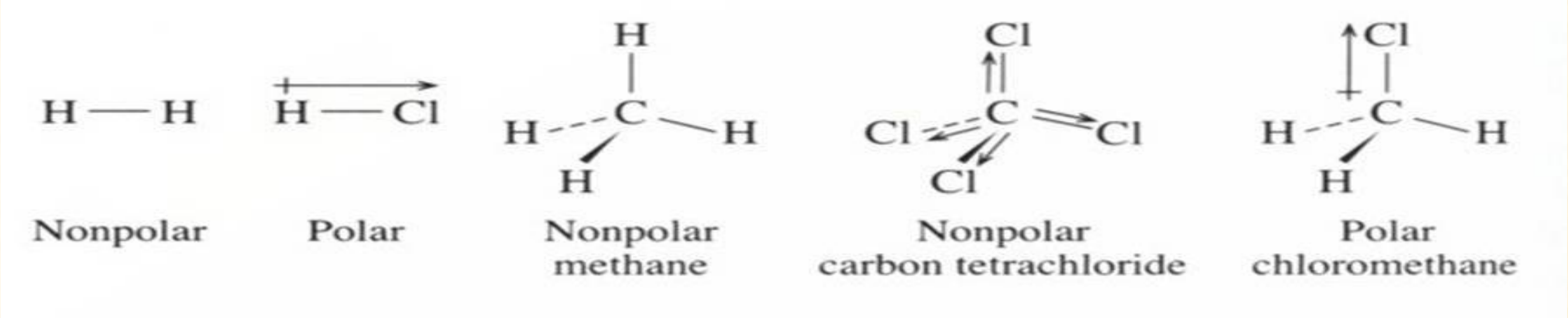
**Nonpolar**

**Increasing polarity of covalent bonds**

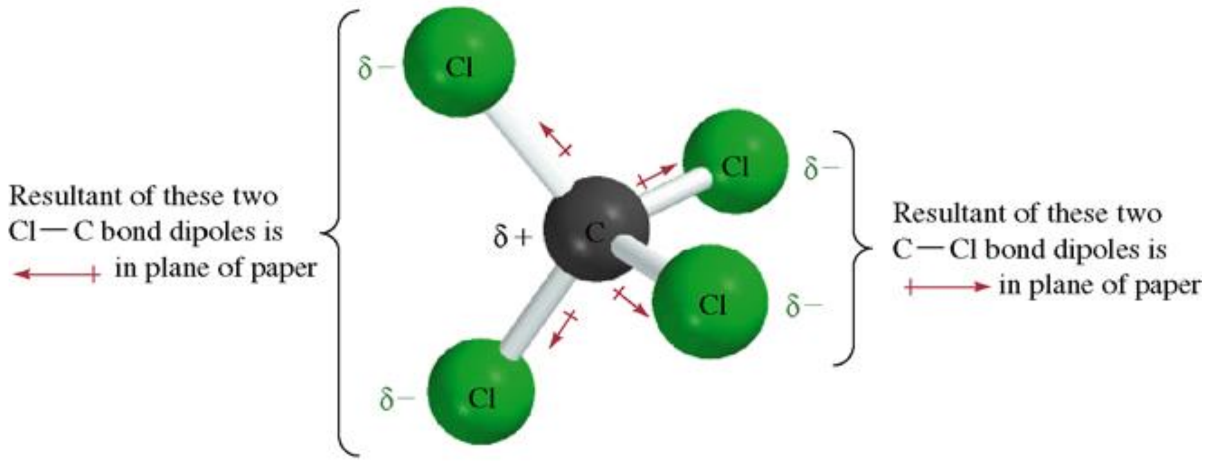
# POLARITY OF ORGANIC MOLECULES

The polarity of a molecule is determined by the polarity of its bonds and the structure of the molecule. A bond between identical atoms is nonpolar, which makes molecules such as $H_2$ and $Cl_2$ nonpolar. A polar bond forms between atoms of different electronegativity values, which makes a molecule such as HCl polar. However, when molecules consist of several polar bonds, the arrangement of the bonds determines whether it is a polar or nonpolar molecule.

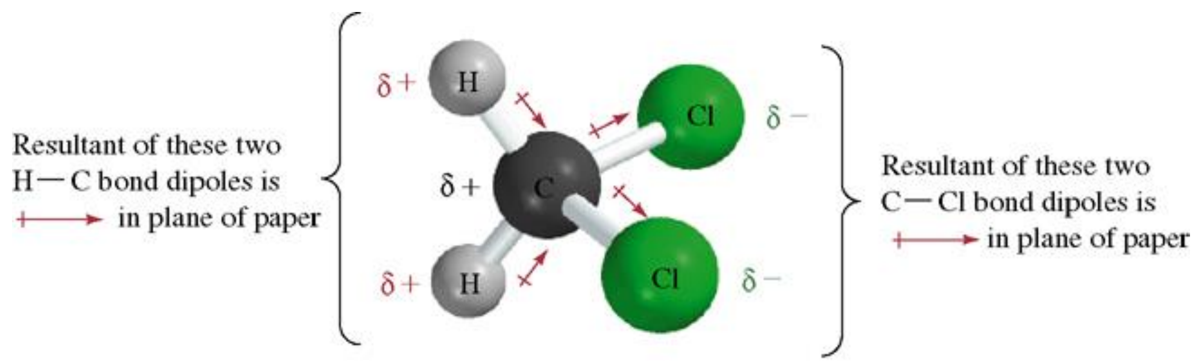
If a molecule contains a symmetrical arrangement of polar bonds so that the dipoles cancel out, the molecules is nonpolar. For example, $CCl_4$ is nonpolar because  However, if there are different atoms bonded to carbon. the dipoles are not likely to cancel each other, which makes the molecule polar. For example, the $CH_3Cl$ molecule is polar because the C---Cl bond is much more polar than the C---H bonds.



# Contribution of individual bond dipole moments to molecular dipole moments




(*a*) There is a mutual cancellation of individual bond dipoles in carbon tetrachloride. It has no dipole moment.




(*b*) The H—C bond dipoles reinforce the C—Cl bond moment in dichloromethane. The molecule has a dipole moment of 1.62 D.