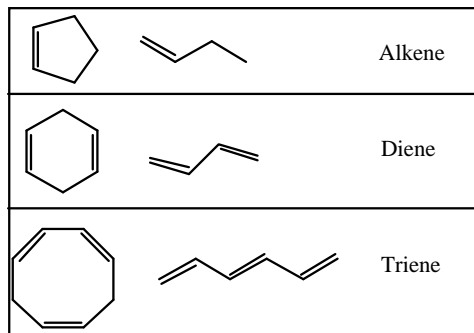


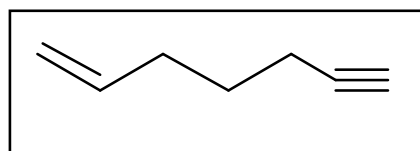
I. Functional Groups With Carbon-Carbon Multiple Bonds

Alkenes and aromatic compounds contain sp^2 hybridized carbon atoms and have pi bonds associated with them. Alkenes contain only double bond. Aromatic compounds can contain both double bonds and triple bonds. Alkynes contain only triple bonds and can be classified as terminal or internal. Enynes are organic molecules that contain both double and triple bonds.

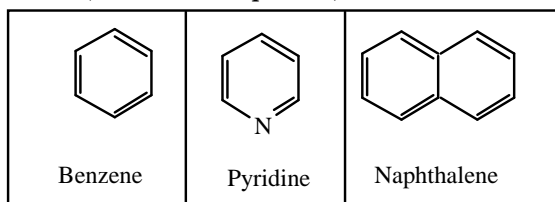
Alkenes



Alkynes

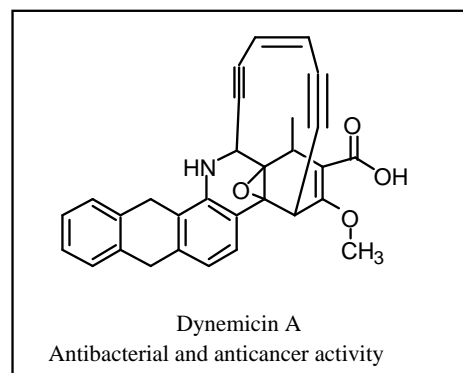
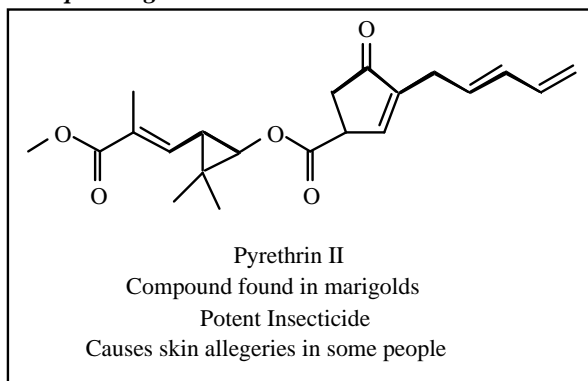


Arenes (Aromatic Compounds)



Enynes

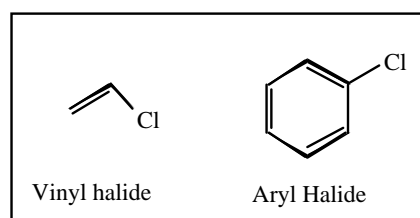
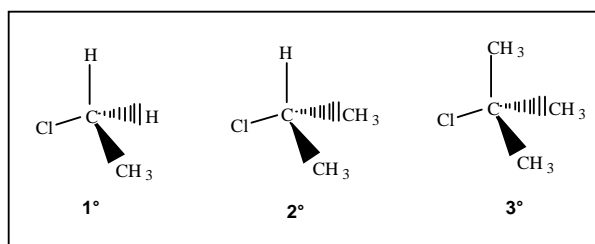
Example drug molecules:



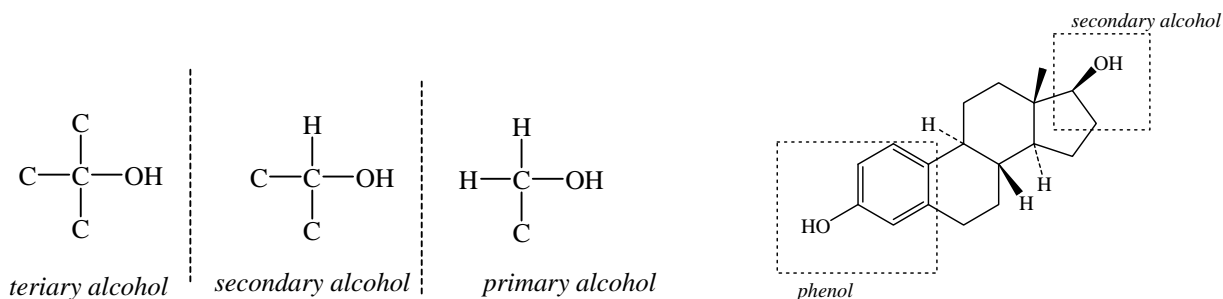
II. Functional Group with Carbon Singly Bonded To An Electronegative Element

- A. Alkyl Halides: Alkyl halides contain a halogen atom bonded to an sp^3 carbon. They may be 1° , 2° or 3° depending on the substitution of the carbon atom bonded to the halogen. Vinyl halides are organic compounds which contain a halogen bonded to the sp^2 carbon of an alkene. Aryl halides are organic compounds which contain a halogen bonded to the sp^2 carbon of an aromatic system.

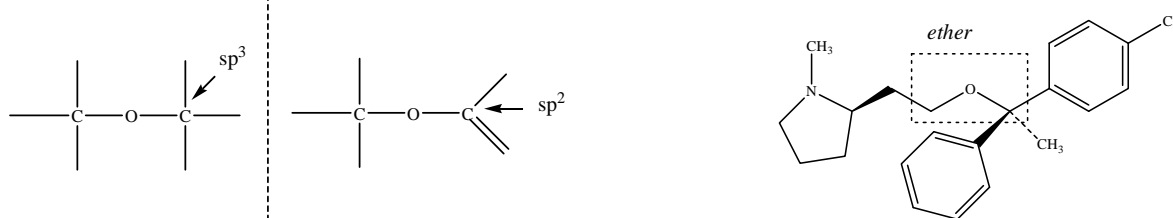
Alkyl Halides



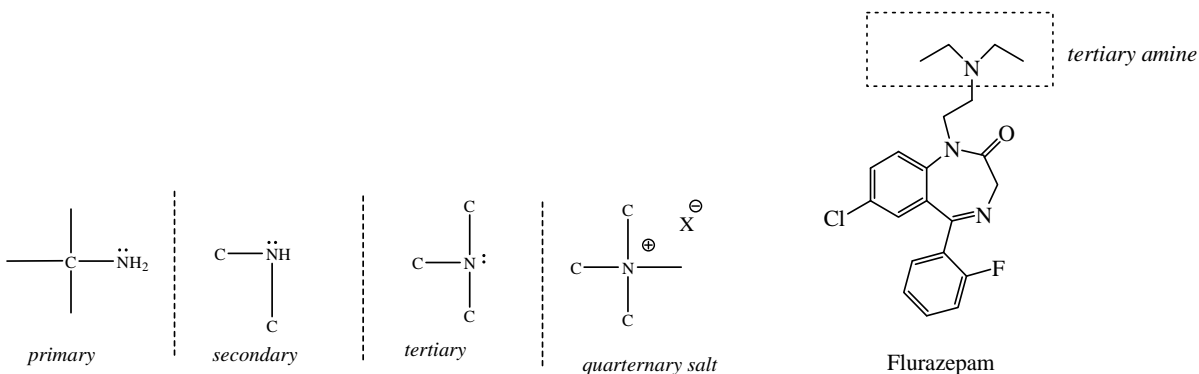
- B. Alcohols: Alcohols contain an -OH group bonded to an sp^3 carbon. Alcohols are designated as primary (1°), secondary (2°) or tertiary (3°) depending on the substitution of the carbon atom to which the hydroxyl group is bonded.



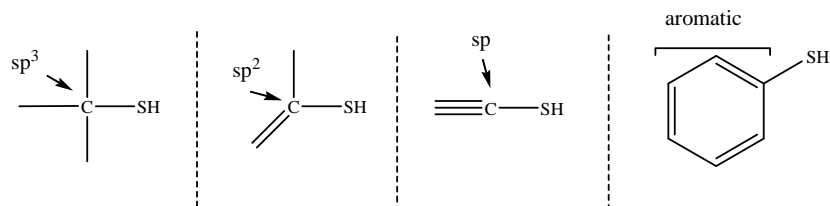
- C. Ethers: Ethers are organic compounds which contain an oxygen bonded to two carbon atoms. The carbons may be sp^2 or sp^3 hybridized.



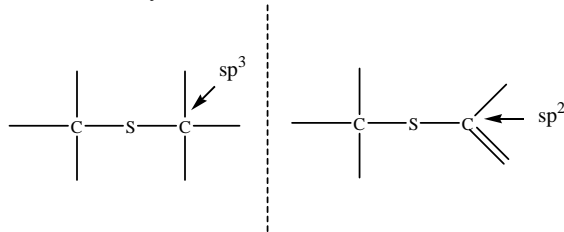
- D. Amines: Amines are organic compounds which contain a nitrogen atom bonded to one or more sp^3 carbons. Amines may be designated as primary, secondary or tertiary depending on the number of carbon atoms the N atom of the amine is bonded to.



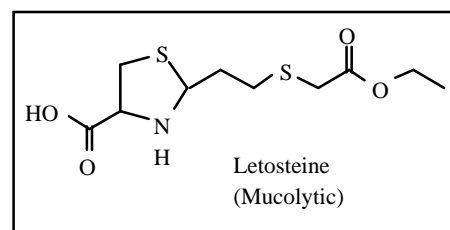
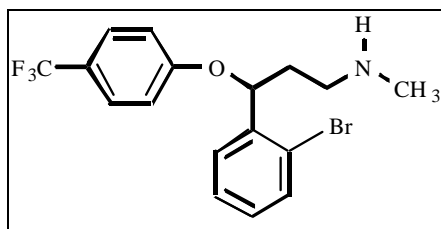
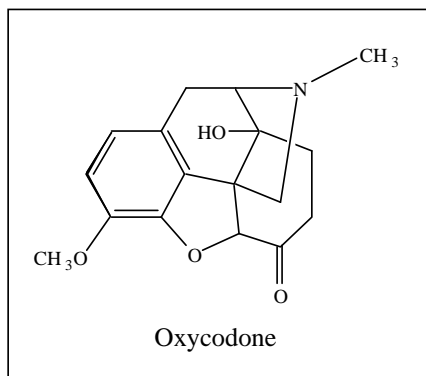
- E. Thiols: Thiols are organic compounds which contain an -SH group bonded to an sp^3 carbon. Thiols are related structurally to alcohols.



- F. Sulfides: Sulfides are organic compounds which contain a sulfur atom bonded to two carbon atoms. The carbons may be sp , sp^2 or sp^3 . Sulfides are structurally related to ethers

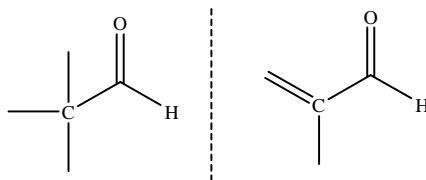


Example Drug Molecules:

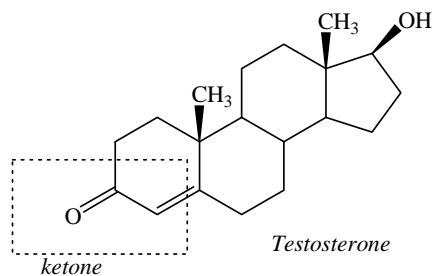
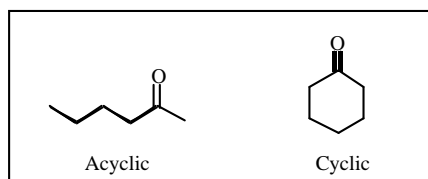


III. Functional Groups with A Carbon-Oxygen Double Bond

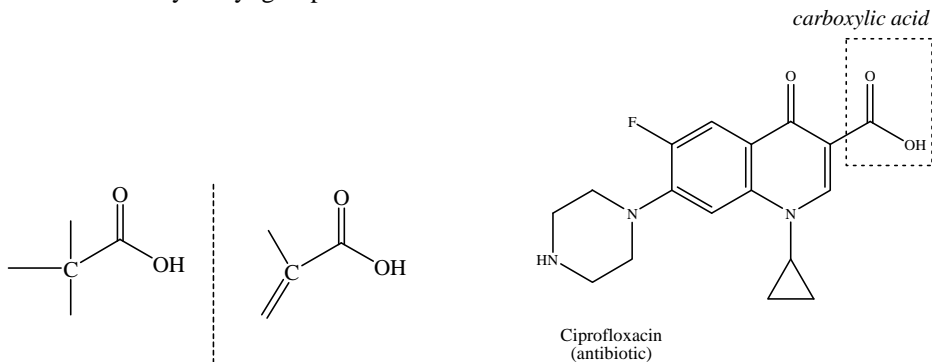
- A. Aldehydes: Aldehydes contain a carbon oxygen double bond. The carbon atom of the carbonyl group is also bonded to one hydrogen and one carbon atom



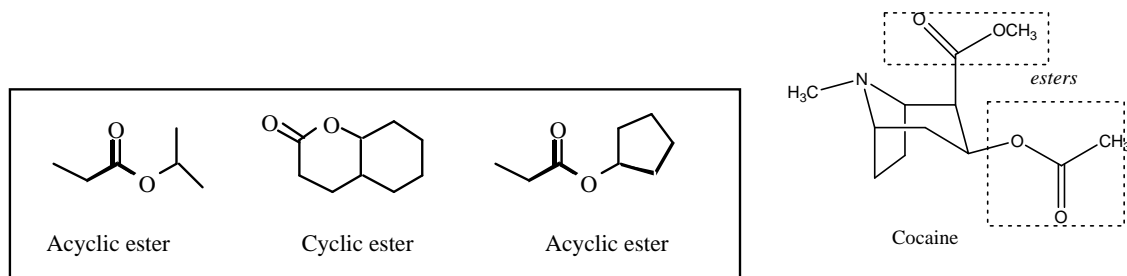
- B. Ketones: Ketones contain a carbon oxygen double bond. The carbon atom of the carbonyl is also bonded to two other carbon atoms. Ketones may be acyclic or cyclic.



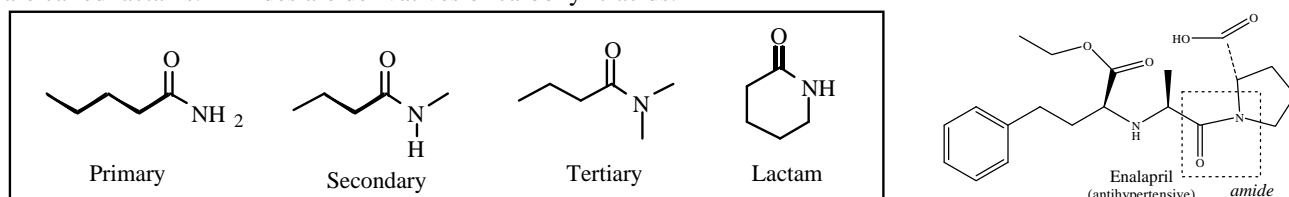
- C. Carboxylic Acids: Carboxylic acids contain a carbonyl group. The carbon atom of the carbonyl group is bonded to another carbon atom and a hydroxyl group.



- D. Esters: contain a carbonyl group. The carbon atom of the carbonyl group is bonded to another carbon atom and an ether type oxygen, i.e., an oxygen bonded to another carbon. Esters are considered to be derivatives of carboxylic acids. Cyclic esters are called lactones.

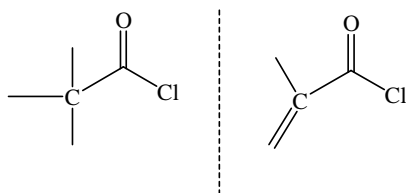


- E. Amides: contain a carbonyl group. The carbon atom of the carbonyl group is bonded to another carbon atom and a nitrogen atom. Amides can be primary secondary or tertiary. The nitrogen atom of the primary amide is bonded to the carbonyl carbon and two hydrogens. The nitrogen atom of a secondary amide is bonded to the carbonyl carbon, one hydrogen and another carbon. The nitrogen atom of a tertiary amide is bonded to the carbonyl carbon and two other carbons. Cyclic amides are called lactams. Amides are derivatives of carboxylic acids.



- F. Acid Chlorides

Acid chlorides are organic compounds which contain a carbonyl group bonded to a chlorine atom. Other halogens may also be bonded to carbonyl groups. These compounds are acid bromides, acid chlorides...Acid chlorides are derivatives of carboxylic acids.



G. Anhydrides

Anhydrides are organic compounds which contain two carbonyl groups. The carbonyl groups are separated from each other by an oxygen atom. Anhydrides may be acyclic or cyclic and are derivatives of carboxylic acids.



IV. Heterocycles and Biologically Important Functional Groups

