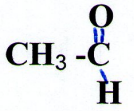
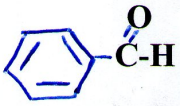
ALDEHYDES AND KETONES

Compunds that contain the carbonyl group(- C(=O) -).An aldehyde contains a carbonyl group whose carbon is bonded to one hydrogen And either an alkyl or an aryl group.



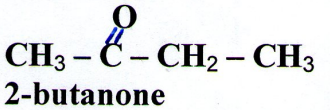
Acetaldehyde



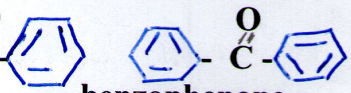
banzaldehyde

The aldehyde group is often written RCHO for convenience .

A ketone contains a carbonyl group whose carbon is bonded to two alkyl groups ,two aryl groups,or one alkyl and one aryl group.

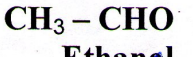


2-butanone

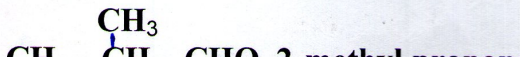


acetophenone benzophenone

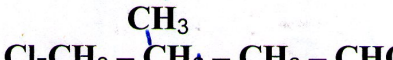
To name aldehydes and ketones the (-ic)or (-oic acid)ending of the name of carboxylic acid replaced by (-aldehyde) formic acid be formaldehyde,acetic acid be acetaldehyde.Replacement (-e)from alkane name by (-al) to name aldehyde ethane be ethanal,2-phenyl ethane be 2-phenyl ethanal.In aldehyde carbonyl group must be at the of chain.



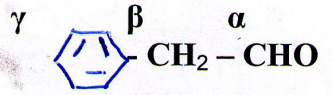
Ethanal



2-methyl propanal

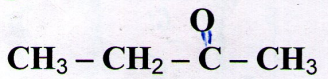


4-chloro -3- methyl butanal

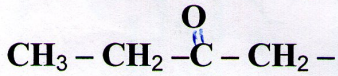


2-phenyl ethanal

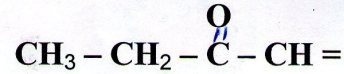
The common name of ketones are formed by placing the names of groups attached to the carbonyl group as prefixes to the word ketone



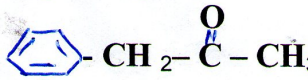
ethyl methyl ketone



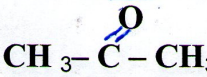
diethyl ketone



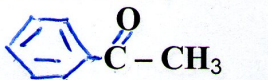
ethyl vinyl ketone



benzyl methyl ketone



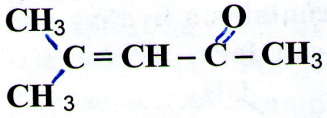
acetone

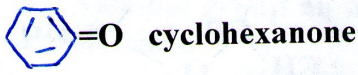


acetophenone

.From the longest carbon chain that contains the carbonyl group by replacing the (-e)with suffix (-one).The location of the carbonyl group is designated the lowest number indicating the position of the carbonyl group

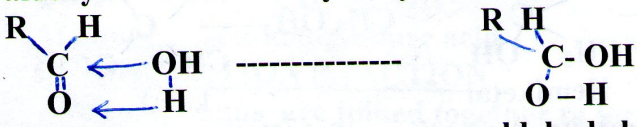

2-pentanone


4-methyl -3-penten-2-one


cyclohexanone

ADDITION OF WATER

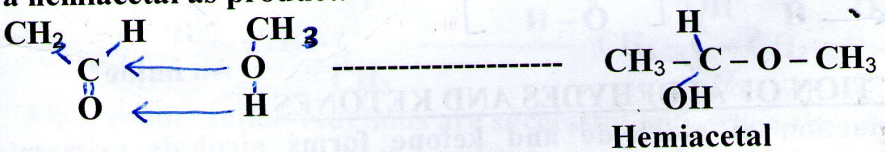
Most aldehydes react with water to form an equilibrium mixture of aldehyde and an aldehyde hydrate.


Aldehyde aldehyde hydrate

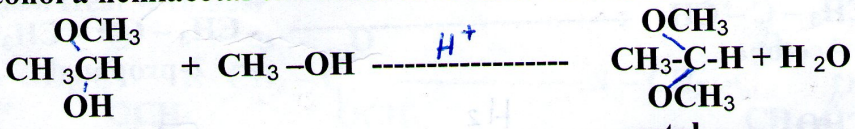
These aldehyde hydrates are 1,1-diols.They are usually too unstable to isolate and purify because they easily lose water to reform the aldehyde.

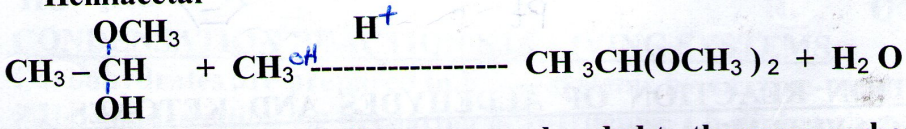
ADDITION OF ALCOHOLS

Aldehyde react with alcohols in the presence of an acid catalyst form a hemiacetal as product.


Hemiacetal

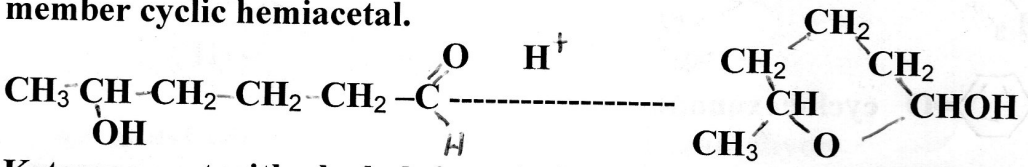
A hemiacetal contains an alkyl and an alcohol group both bonded to the original carbon of carboxyl group .In the presence of excess alcohol a hemiacetal can react to form an acetal and water


Hemiacetal acetal

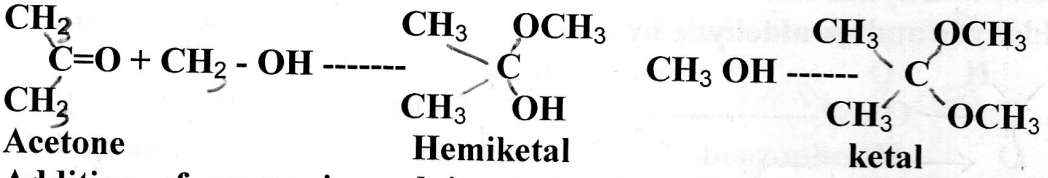


An acetal contains two alkoxy groups bonded to the same carbon Thus an acetal resembles an ether,and its reactions are similar to those of ether.Acetals are stable and unreactive to aqueouse base ,but are cleaved by aqueous acid to their aldehyde and alcohol components.The reaction of aldehydes and alcohols to form hemiacetals and acetals is readily reversible.The reversibility of this reaction is an important feature of the reaction of carbohydrates that

Contain a hemiacetal functional group.In addition to forming hemiacetals between two different molecules such a reaction can occur within a molecule .Thus molecule that contains a hydoxy and an aldehyde group in the proper positions can form five or six-member cyclic hemiacetal.

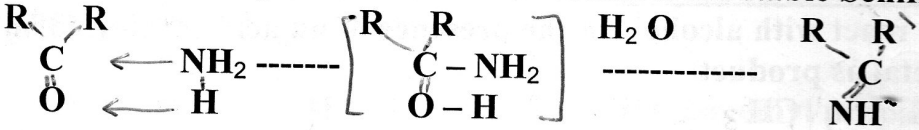


Ketones react with alcohols in a similar manner to form hemiketals And ketals



Acetone Hemiketal ketal

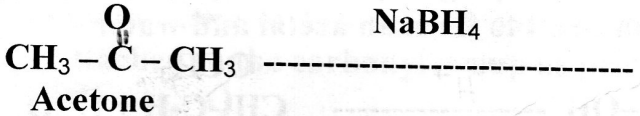
Addition of ammonia and its derivatives (Schiff base)compounds having the general structures RHC=NR and R_2 C=NR are called aldimines,respectively .These compounds are also generally called Schiff base of ammonia are usually unstable and undergo further reaction but many derivatives of ammonia from stable Schiff base.



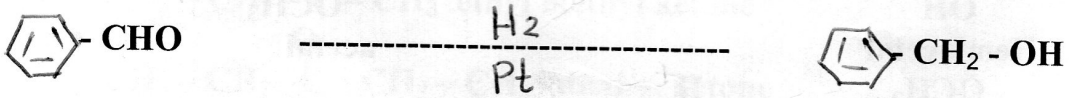
An imine

REDUCTION OF ALDEHYDES AND KETONES

The reduction of aldehyde and ketone forms alcohols primary alcohols are formed from aldehyde ,whereas secondary alcohols are formed from ketones

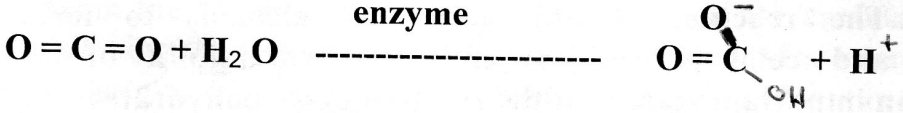


Acetone 2-propanal



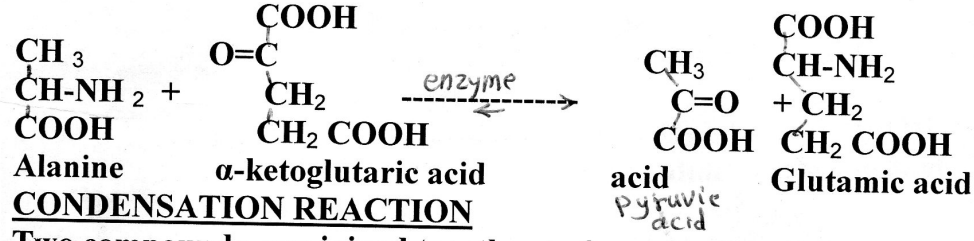
ADDITION REACTION OF ALDEHYDES AND KETONES IN LIVING SYSTEM

One of the simplest addition reactions of carbonyl group in living systems is the enzyme-catalyzed hydration of carbon dioxide to bicarbonate ion according to the following equations



The enzyme that catalyzes this reaction is widely distributed in mammals.It is especially active in tissues that are involved in respiration ,such as red blood cells.The formation of Schiff bases is an important reaction in the formation of many compound in living systems .One example the transamination reaction.

The α-amino group an amino acid is transferred to the α-carbon of an α-ketoacid

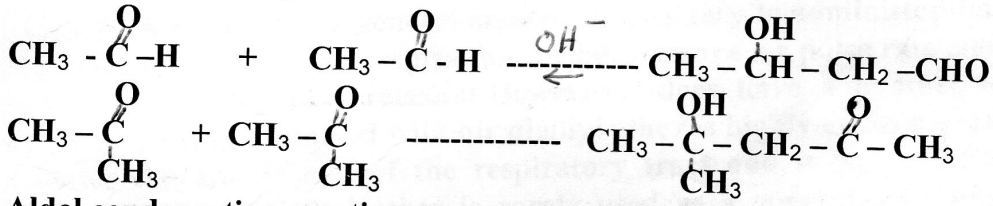


CONDENSATION REACTION

Two compounds are joined together to form one larger compound.

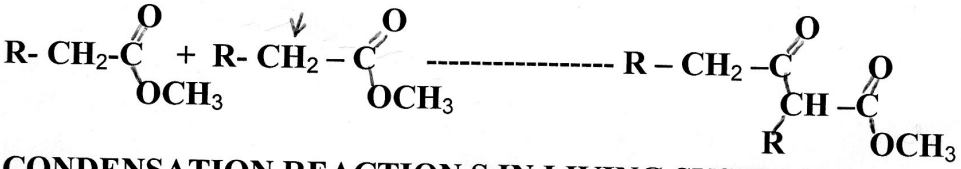
The aldol condensation and claisen condensation .

1-An aldol condensation reaction is a reaction in which the carbonyl carbon of one molecule forms bond with the α-carbon of another carbonyl containing molecule.



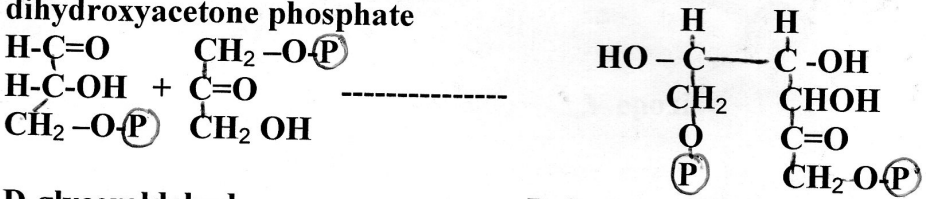
Aldol condensation reactions are successful only when the (α-) carbon of ketone adds to the carbonyl group of an aldehyde that doesnot have (α-) hydrogens.

2-Claisen condensation:esters undergo the condensation reactions when treat with base.



CONDENSATION REACTION S IN LIVING SYSTEMS

Carbohydrates are prepared in living systems by enzyme-catalyzed Aldol condensation .eg preparing of D-fructose 1,6-diphosphate by the condensation of D-glyceraldehyde-3-phosphate and 1,3-dihydroxyacetone phosphate



D-glyceraldehyde 3-phosphate

D-fructose 1,6-diphosphate