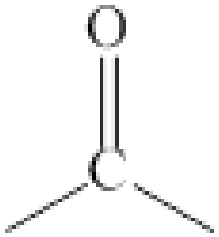
POLY- AND HETEROFUNCTIONAL COMPOUNDS

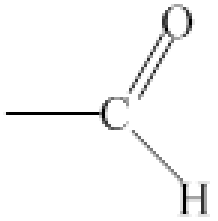
Heterofunctional compounds are the compounds that contain two or more different functional groups.

- amino-alcohols: $-NH_2$ $-OH$
- hydro acids $-OH$ $-COOH$

Heterofunctional compounds

- Oxyacid (ketoacids)





$-COOH$

- aminoacids

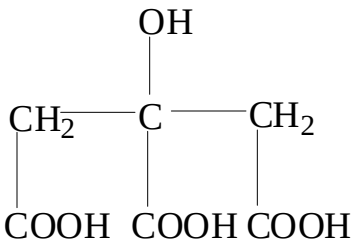
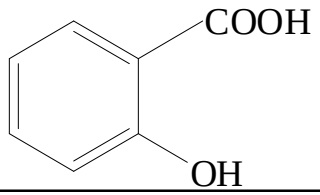
$-NH_2$ $-COOH$

Hydroxyacids

- **Hydroxyacids** are organic compounds that contain a hydroxyl group and a carboxylic group

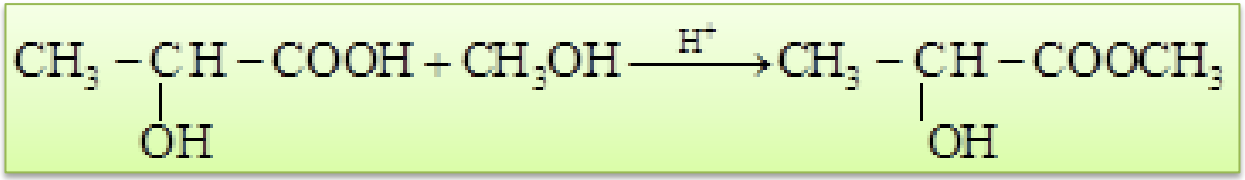
Classification of **Hydroxyacids**

Sign of classification	**Class name**	
the structure of the carbon radical	aliphatic	Aromatic
atomicity (quantity of –OH group) and basicity (quantity of –COOH group)	monobasic diatomic	monobasic diatomic
	dibasic triatomic	
	dibasic tetratomic	monobasic tetratomic
	tribasic tetratomic	
Position of -OH and -COOH groups	α-**Hydroxyacids**	
	β-**Hydroxyacids**	
	γ-**Hydroxyacids**	

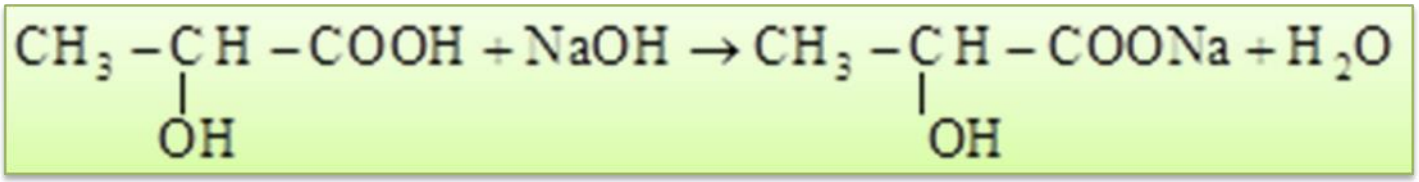
Formula	Name
$HO-CH_2-COOH$	**Glycolic acid**
$CH_3-CH(OH)-COOH$	**Lactic acid**
$HOOC-CHOH-CH_2-COOH$	**Malic acid**
$HOOC-CH(OH)-CH(OH)-COOH$	**Tartaric acid**
	**Citric acid**
	**Salicylic acid**

Chemical properties of Hydroxyacids (properties of COOH group)

- Esterification

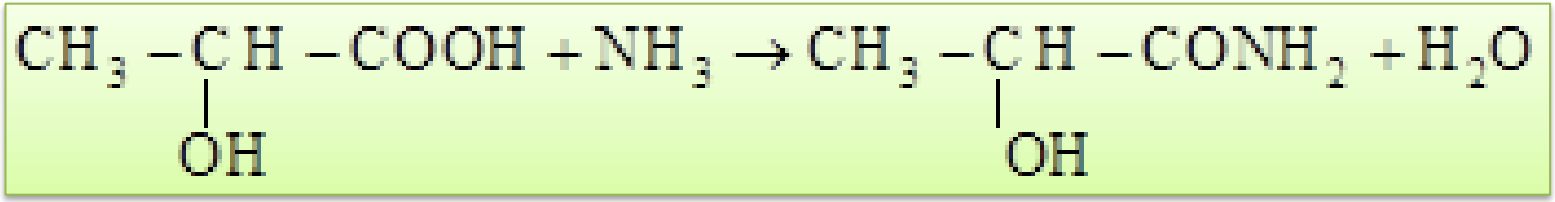


- with NaOH (neutralization)

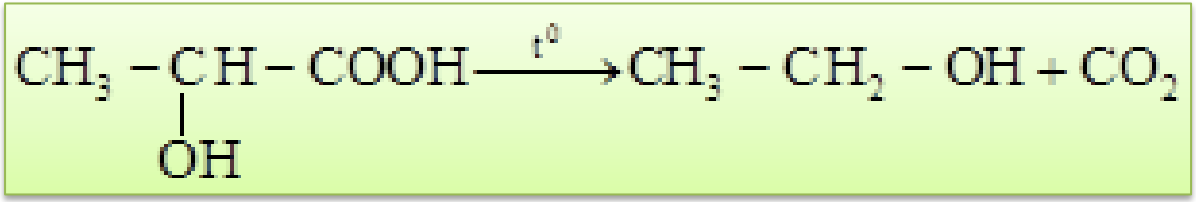


Chemical properties of hydroxyacids (properties of COOH group)

- **formation of amides**



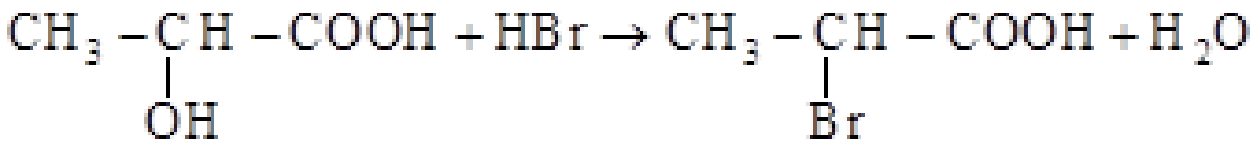
- **Formation of alcohol by decarboxylation.**



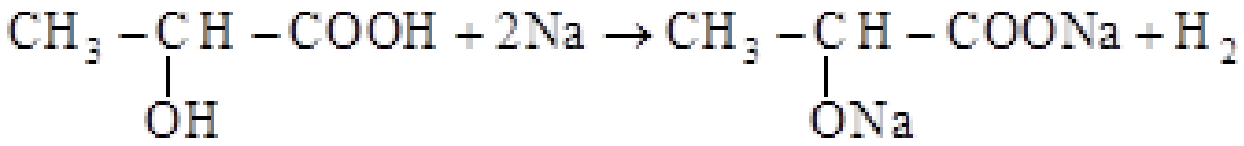
- Loss of CO_2 from a molecule is called decarboxylation.

Chemical properties of hydroxyacids (properties of OH group)

- **The reaction of lactic acid with hydrogen halide, for example HBr:**



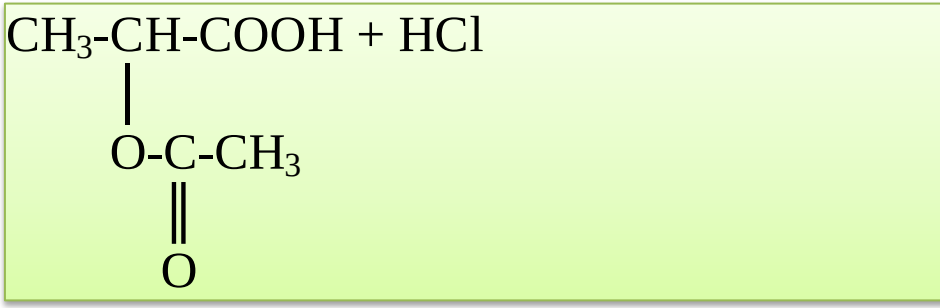
- **With sodium Na:**



Chemical properties of Hydroxyacids (properties of OH group)

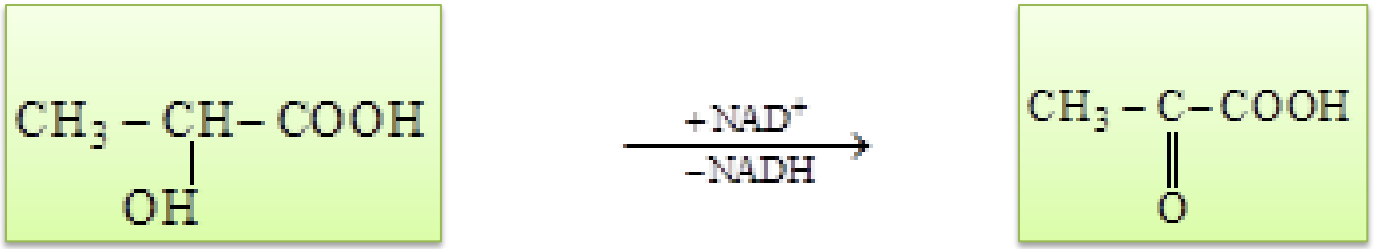
- **with acyl halide, for example acetyl chloride(acetylation or acetylization)**

$$CH_3 - CHOH - COOH + CH_3COCl \rightarrow$$



Chemical properties of Hydroxyacids (properties of OH group)

- **Oxidation (**Oxidation is carried out in living systems (*in vivo)* under the control of a dehydrogenase enzyme such as nicotinamide adenide dinucleotide (NADH)).

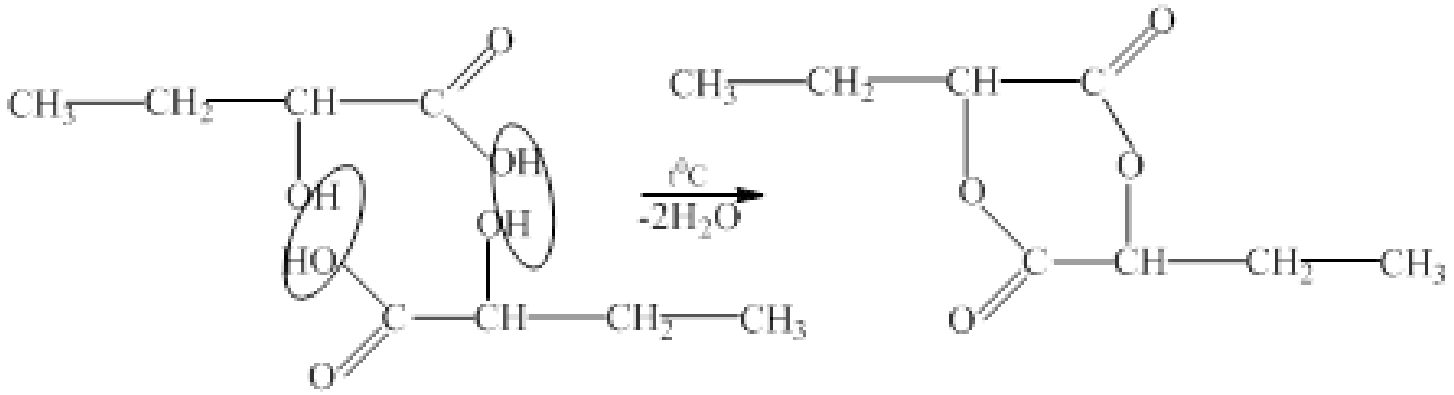


lactic acid

pyruvic acid

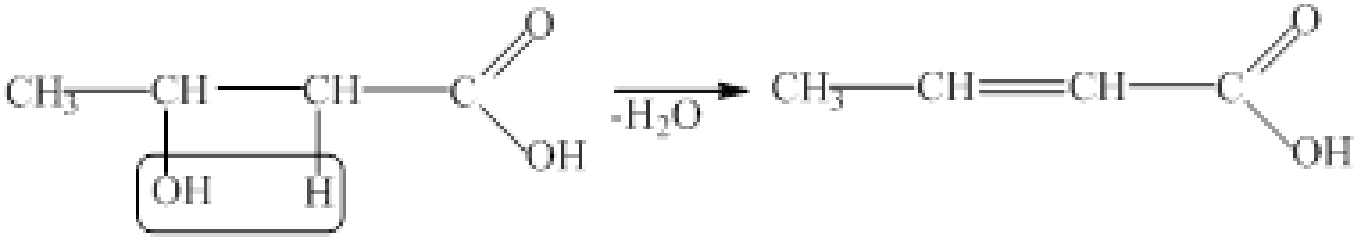
Specific properties

- intermolecular dehydration (for α-hydroxy acids)



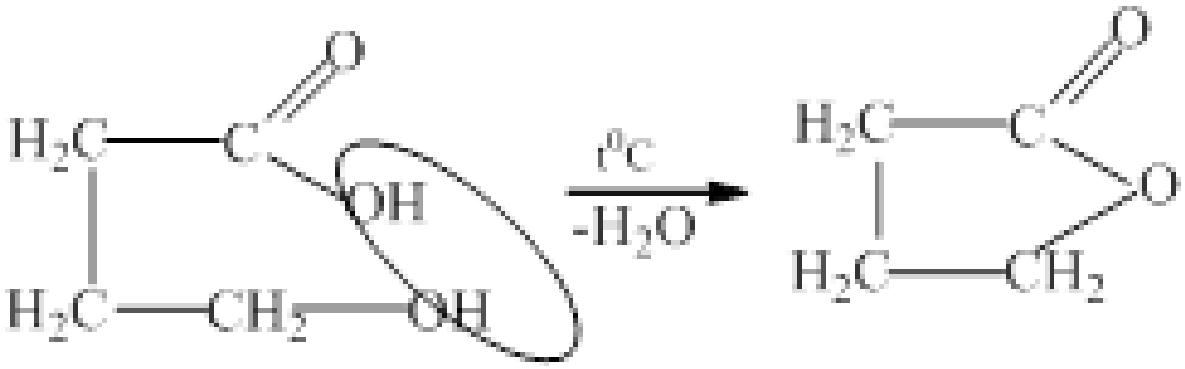
lactide

Intramolecular dehydration(β-hydroxy acids)



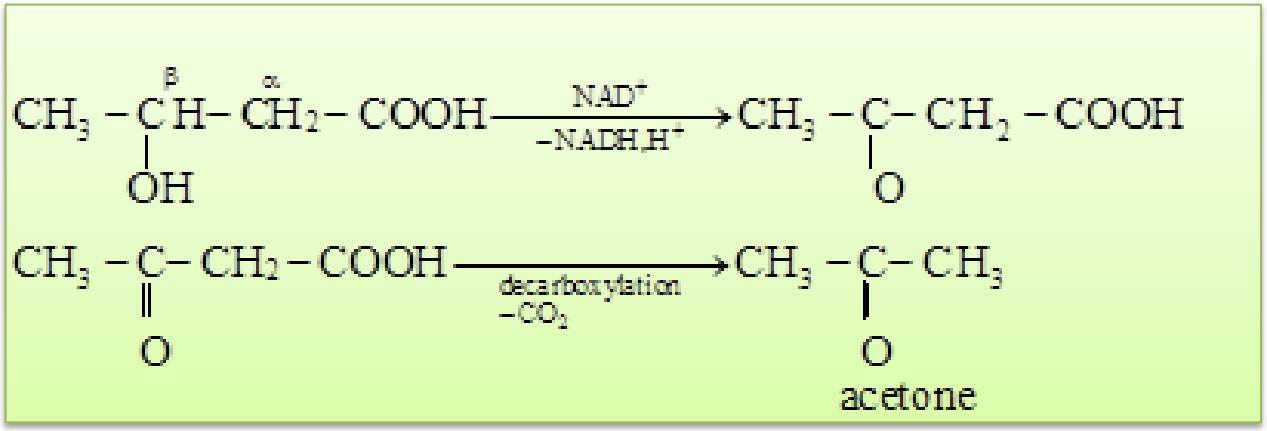
Unsaturated carboxylic acid

Intramolecular dehydration(γ-hydroxy acids)



lactone

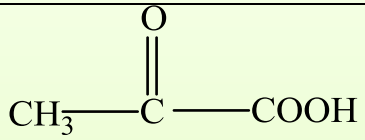
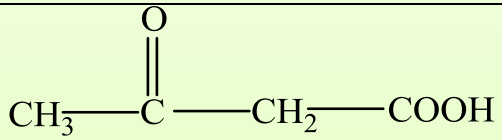
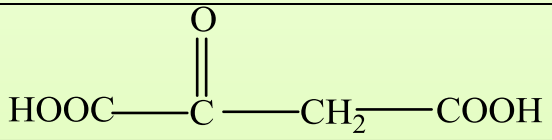
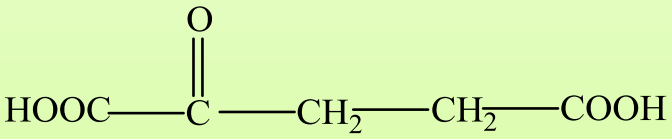
- **Oxidations of β -hydroxyacids and then their decarboxylation takes place in living organisms**



Ketone bodies

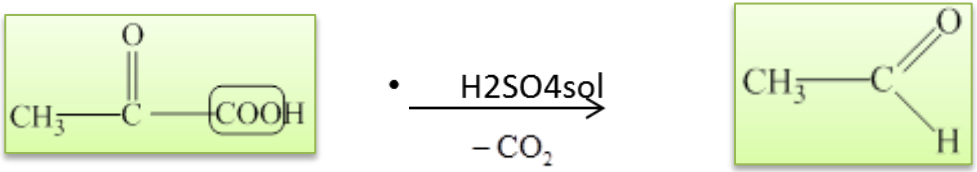
Keto acids

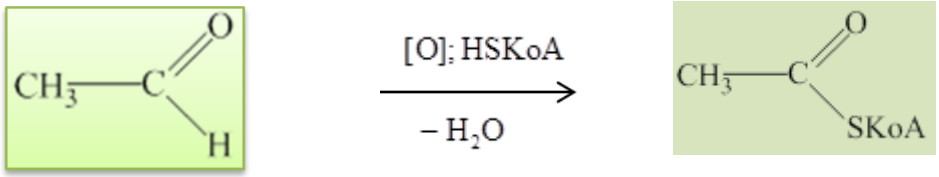
Ketoacids contains –COOH and –C=O groups.

Formula	Name
	**Pyruvic acid**
	**Acetoacetic acid**
	**Oxaloacetic acid**
	α- ketoglutaric acid

Chemical properties of pyruvic acid

- 1) decarboxilation:

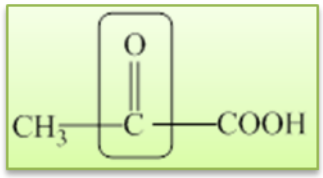




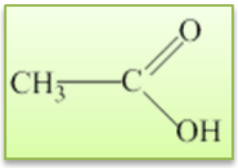
acetyl coenzyme A

Chemical properties of pyruvic acid

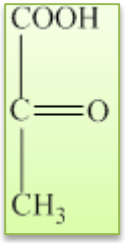
- 2)decarbonization:



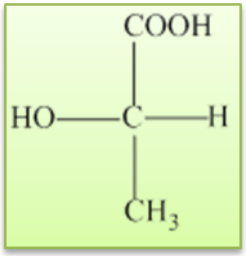
- H2SO4 c
- -CO



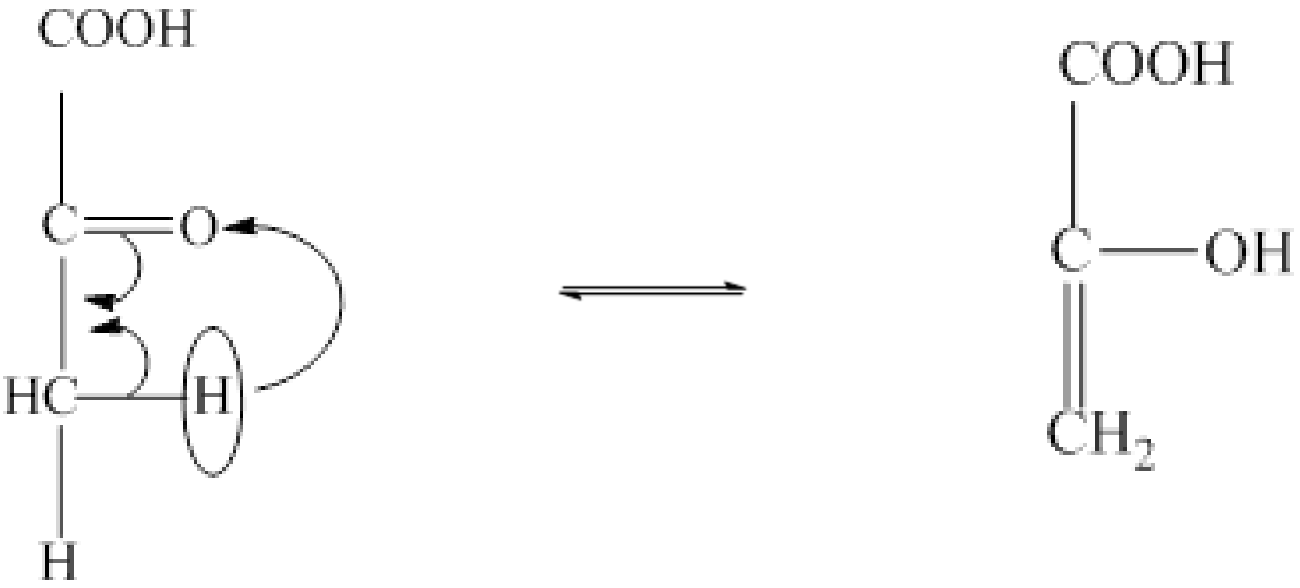
- 3) reduction (*in vivo):*



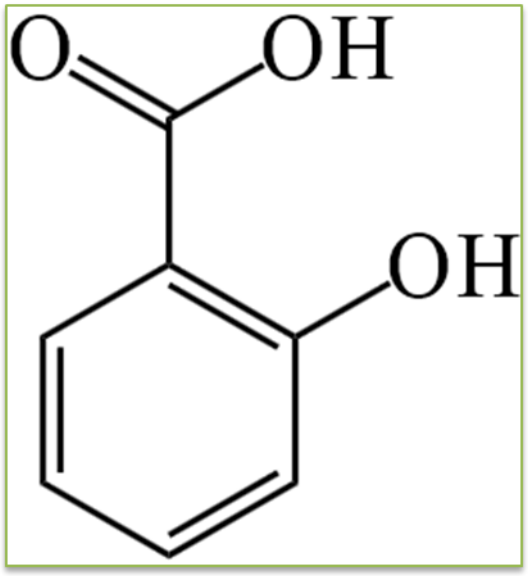
- NAD H2
- NAD +



Keto-enol tautomerism



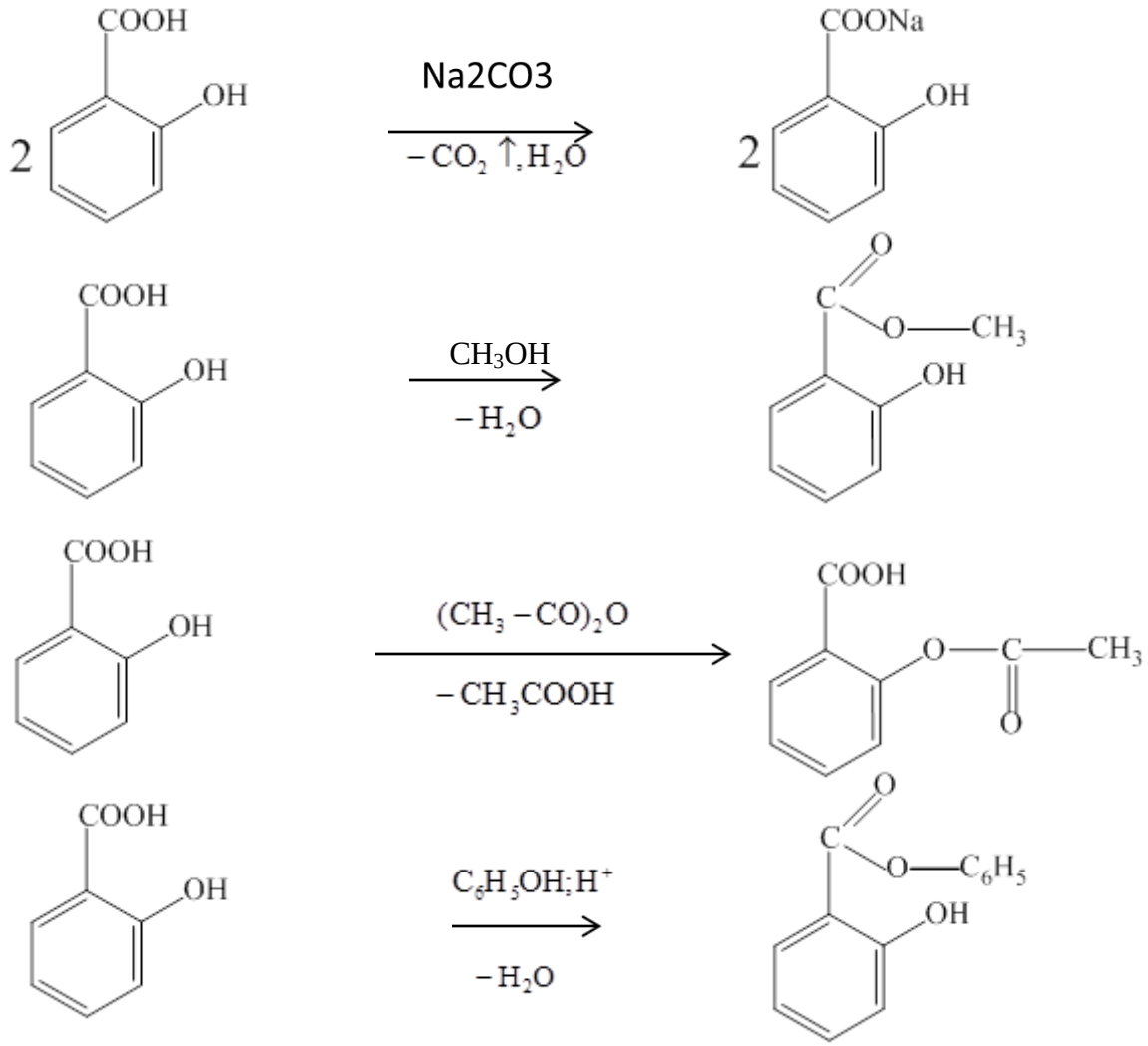
Aromatic Heterofunctional compounds



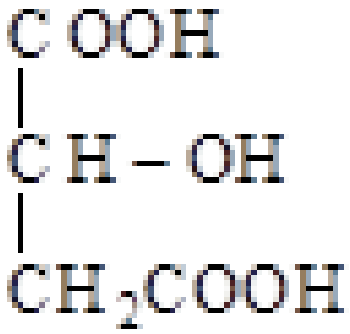
salicylic acid

o-hydroxybenzoic acid

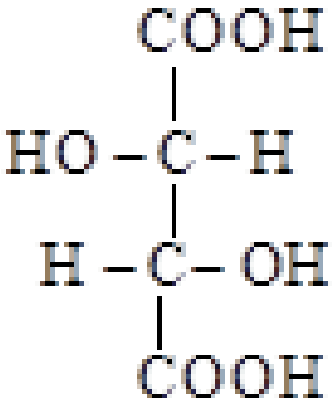
Chemical properties of o-hydroxybenzoic acid.



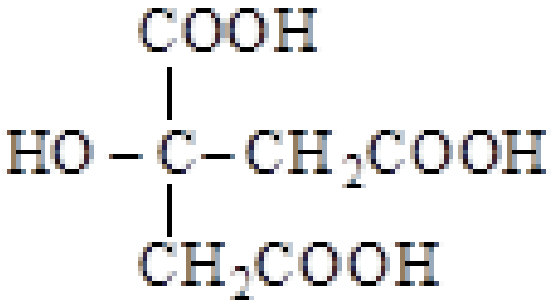
Polyheterofunctional compounds are the compounds that contain more than two different functional groups.



malic acid



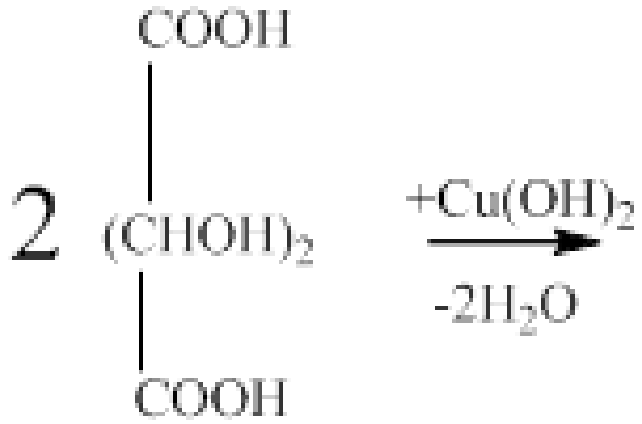
tartar acid

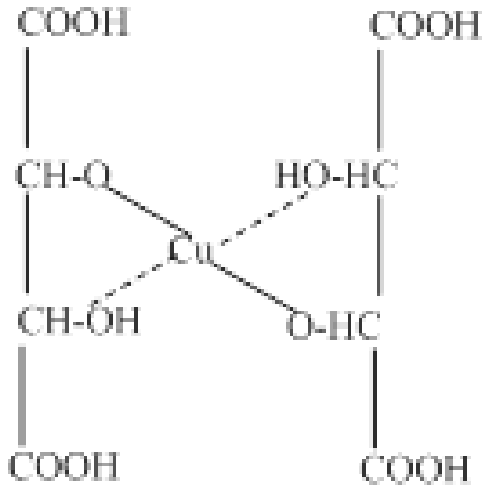


citric acid

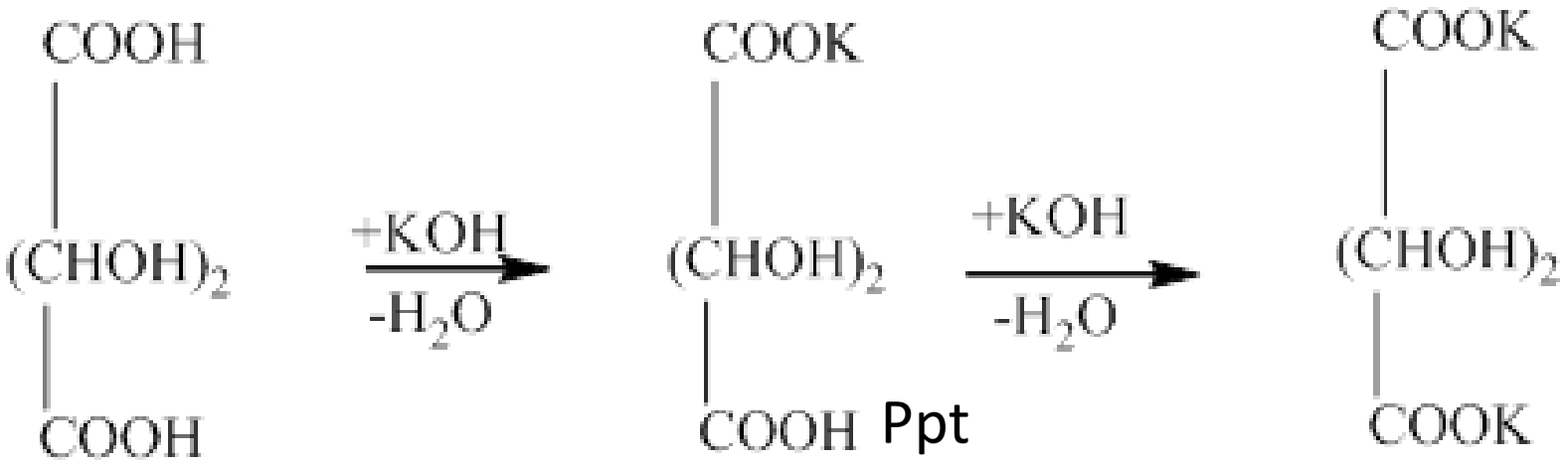
Chemical reactions of tartaric acid

1. A reaction with copper(II) hydroxide in an alkaline medium.



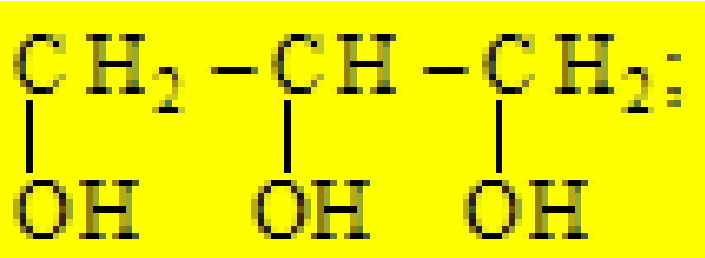


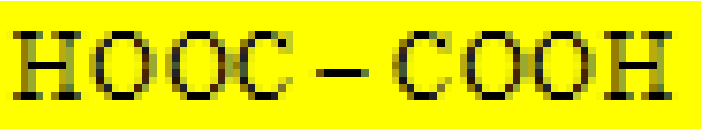
A reaction with KOH



potassium tartrate

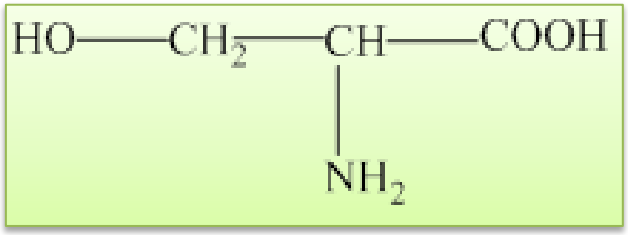
- **Polyfunctional** compounds are the compounds that contain two and more same functional groups.

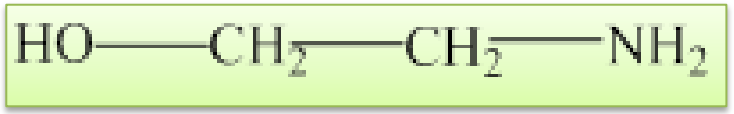


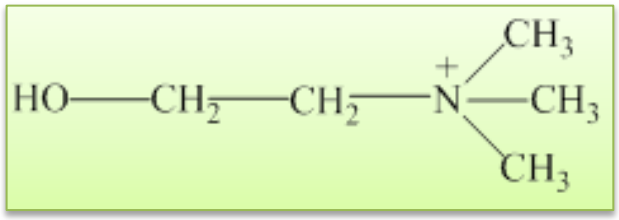


Amino alcohol

- contains $-NH_2$ and –OH groups.
- Amino alcohols are structural components of compound lipids.

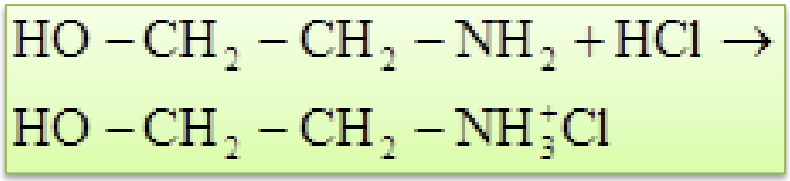




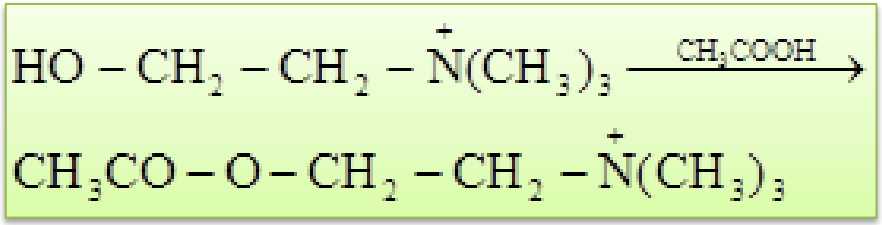


Chemical properties of **amino alcohols**

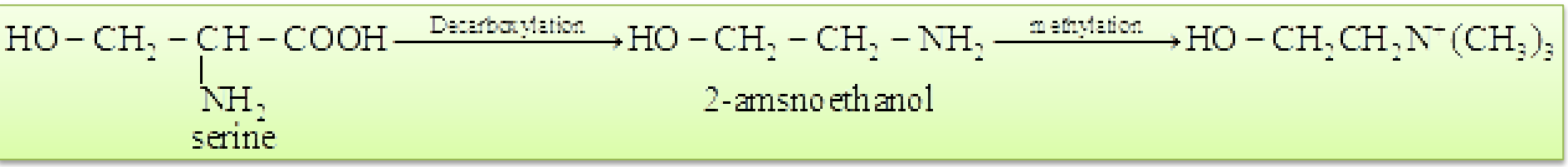
- The reaction with HCL

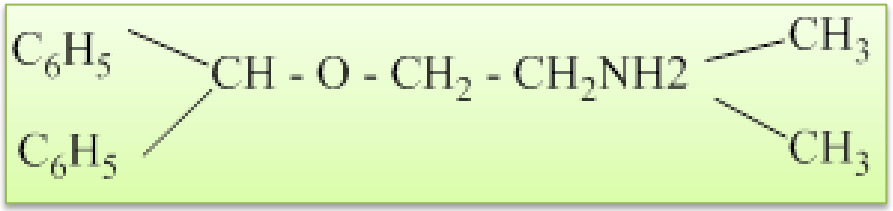


- Acetylation



acetylcholine





diphenhydramine hydrochloride, Benadryl