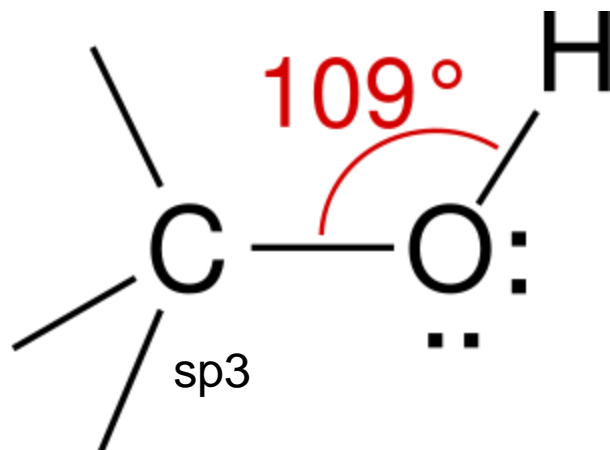


## Alcohol : the functional group



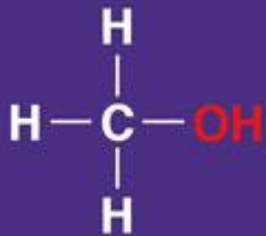
Nomenclature:

\*.e  $\rightarrow$  \*.ol

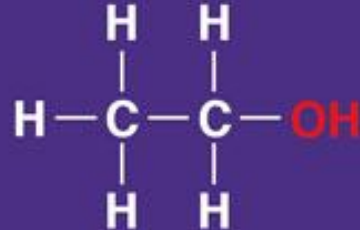
Propan.e  $\rightarrow$  propan.ol

# Alcohol

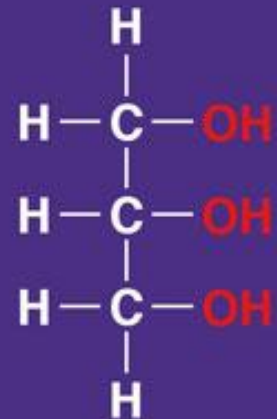
## EXAMPLES OF ALCOHOLS



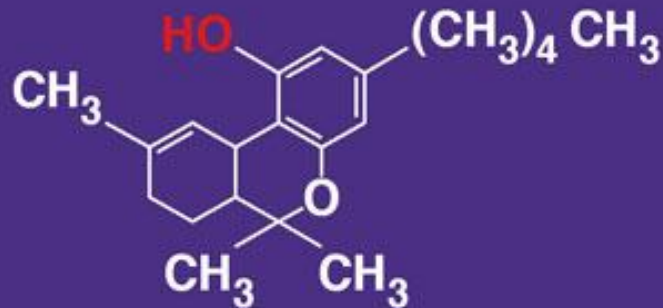
**Methyl Alcohol  
(methanol)**



**Ethyl Alcohol  
(ethanol)**



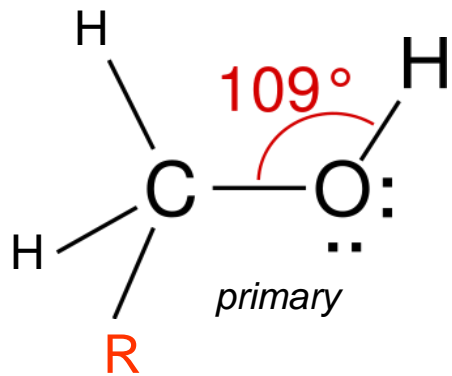
**Glycerol  
(a component  
of fats)**



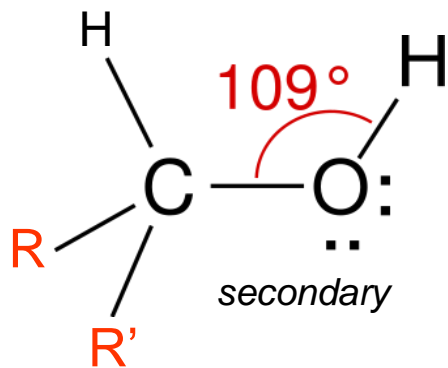
**Tetrahydrocannabinol  
(active ingredient of marijuana and hashish)**



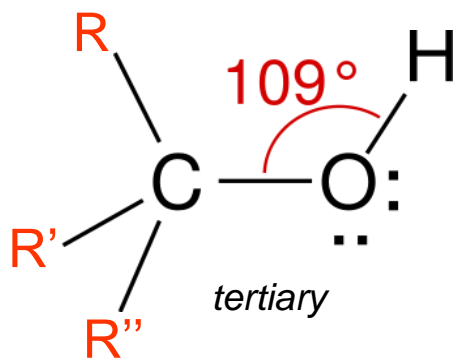
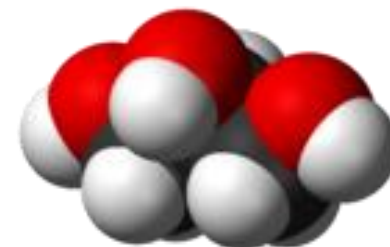
# Reactivity



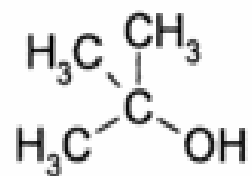
Ex. ethanol



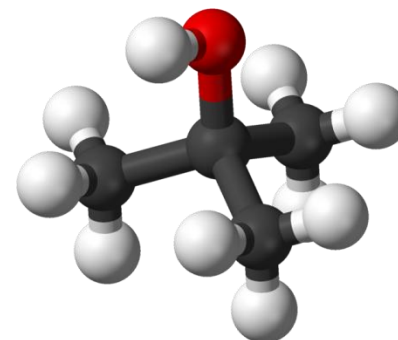
Ex. C2 glycerol



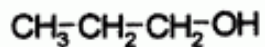
Ex.



2-Methylpropan-2-ol  
A tertiary alcohol

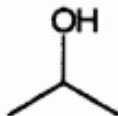
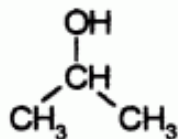


# Alcohols



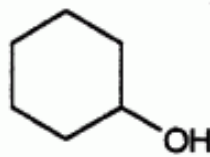
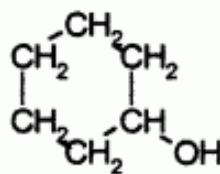
*n*-propyl alcohol  
or propan-1-ol  
or 1-propanol

A **primary** alcohol

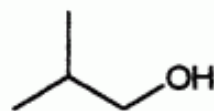
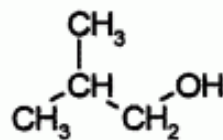


isopropyl alcohol  
or propan-2-ol  
or 2-propanol

A **secondary** alcohol

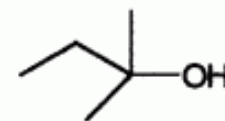
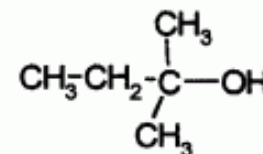


cyclohexanol, a  
**secondary** alcohol



isobutyl alcohol  
or 2-methylpropan-1-ol  
or 2-methyl-1-propanol

A **primary** alcohol



*tert*-amyl alcohol  
or 2-methylbutan-2-ol  
or 2-methyl-2-butanol

A **tertiary** alcohol

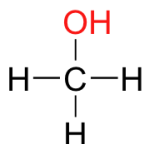
*primary*

*secondary*

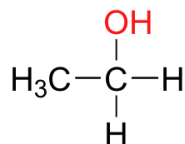
*tertiary*



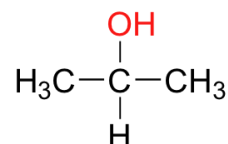
Reactivity decreases



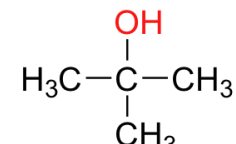
methanol



a primary alcohol

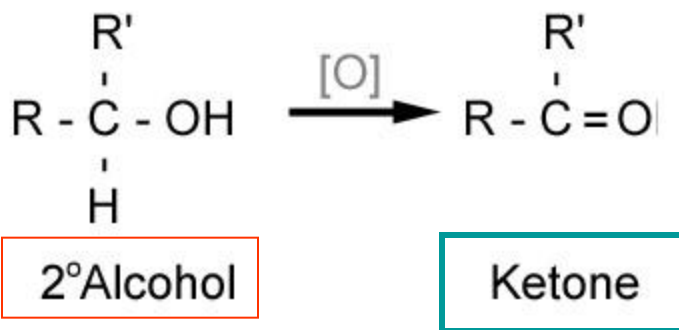
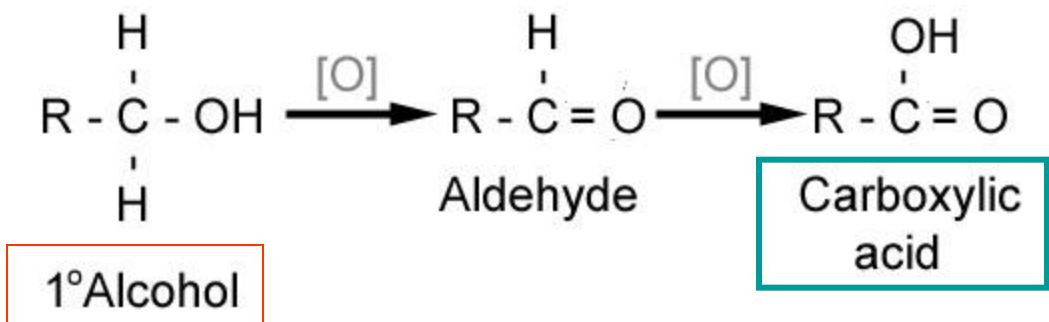


a secondary alcohol



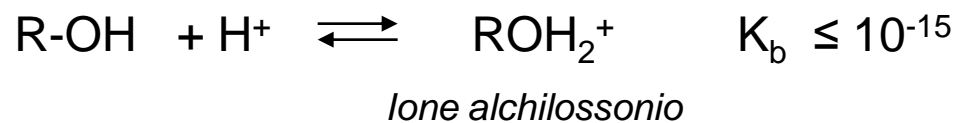
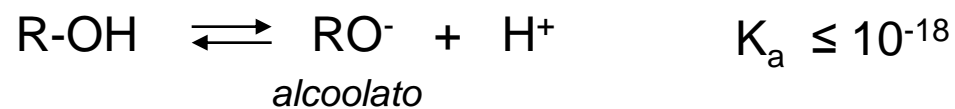
a tertiary alcohol

(primary & secondary) oxidation of alcohols

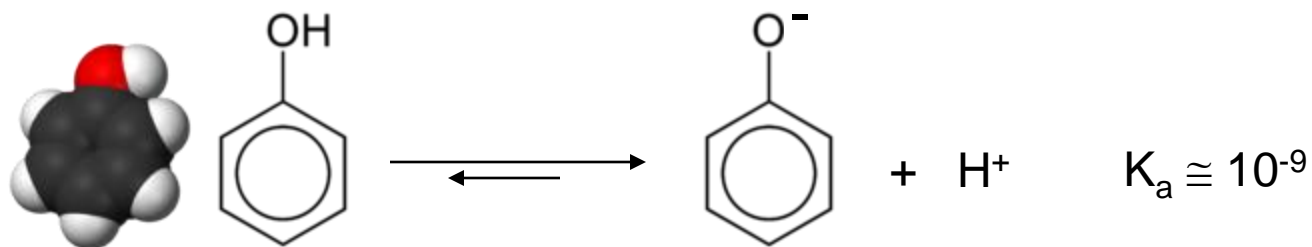


## Alcohols acidity

(very) weak acids and bases

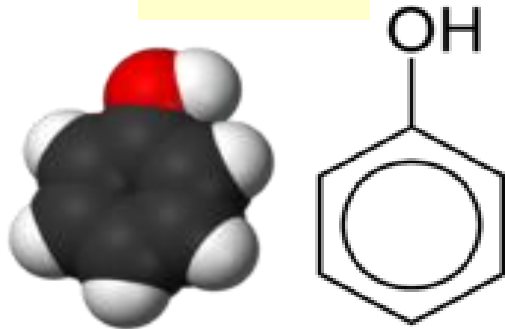


phenols



## Inductive effects and acidity

$K_a \approx 10^{-9}$

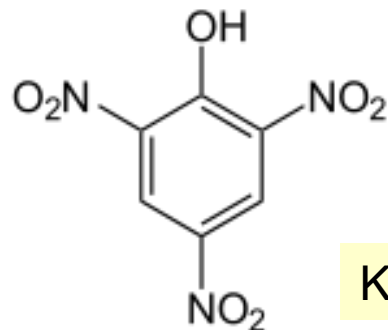
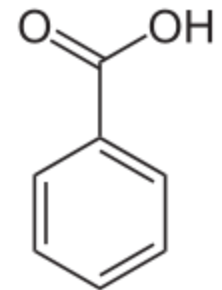


phenol

Benzoic acid



$K_a \approx 10^{-5}$



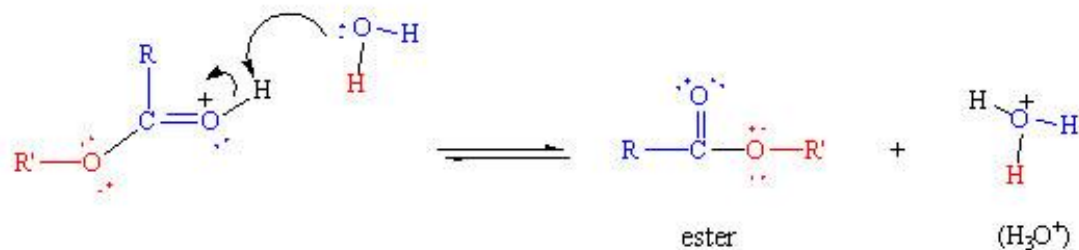
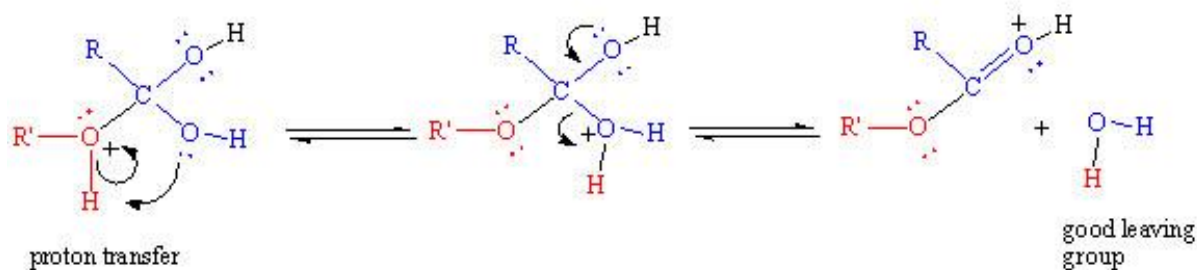
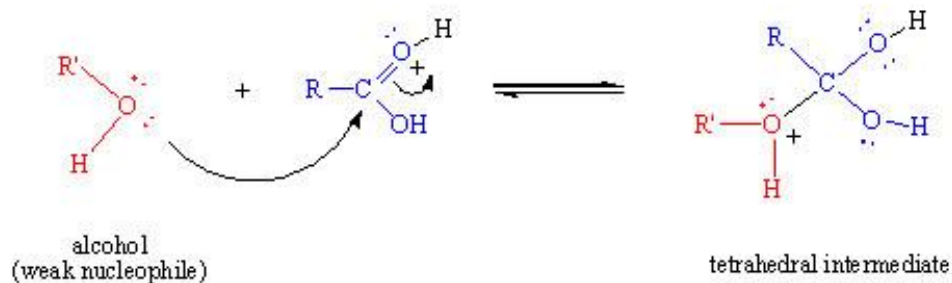
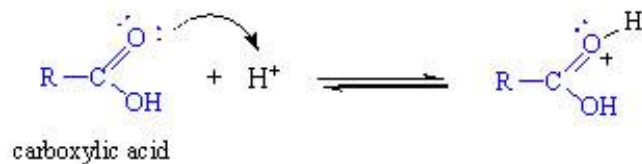
$K_a \approx 10^{-1}$

Tri-nitro-phenol (picric ac.)

Πικρός — "bitter",

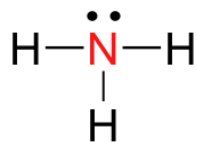
# Alcohol + acid = ester (*Fischer mechanism*)

## Fischer Esterification Reaction Mechanism (nucleophilic acyl substitution)

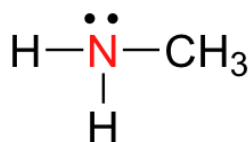




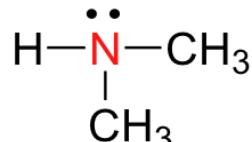
Amines (*Lewis base*)



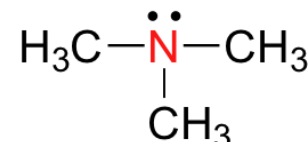
ammonia



a primary amine



a secondary amine



a tertiary amine

*primary*

*secondary*

*tertiary*



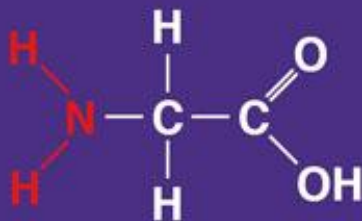
Reactivity decreases

# Amines

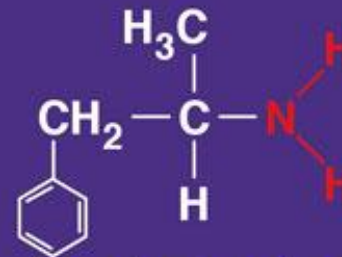
## EXAMPLES OF AMINES



**Methylamine**



**Glycine**  
(an amino acid)

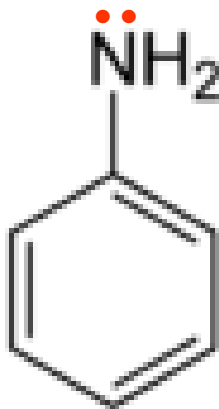


**Amphetamine**

The amino groups are shown here in their **uncharged forms**

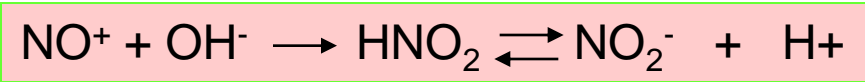


Aromatic

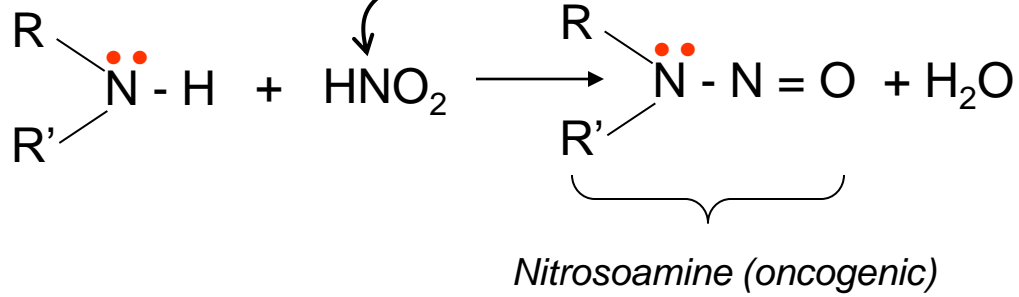


Aniline (*phenylamine - aminobenzene*)

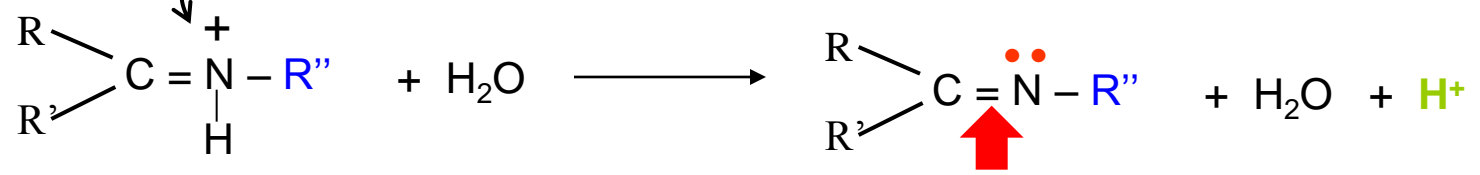
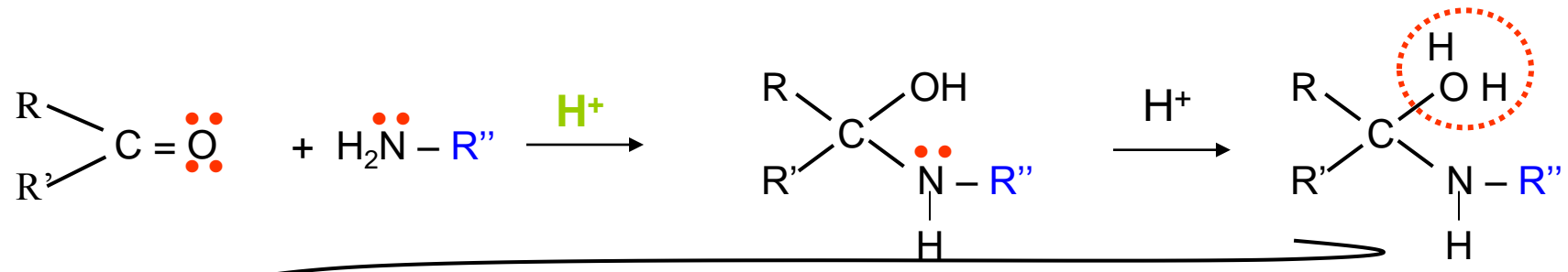
Reactions



Nitration

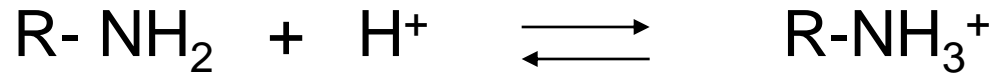


Schiff base production (aldehydes, ketones)

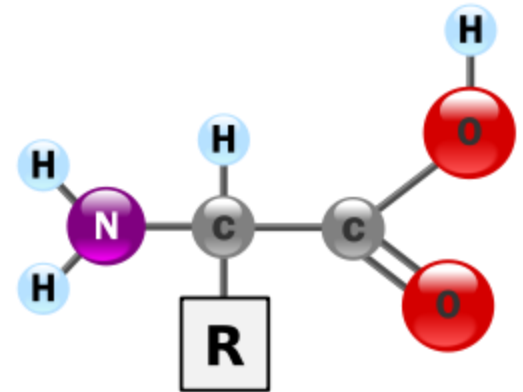
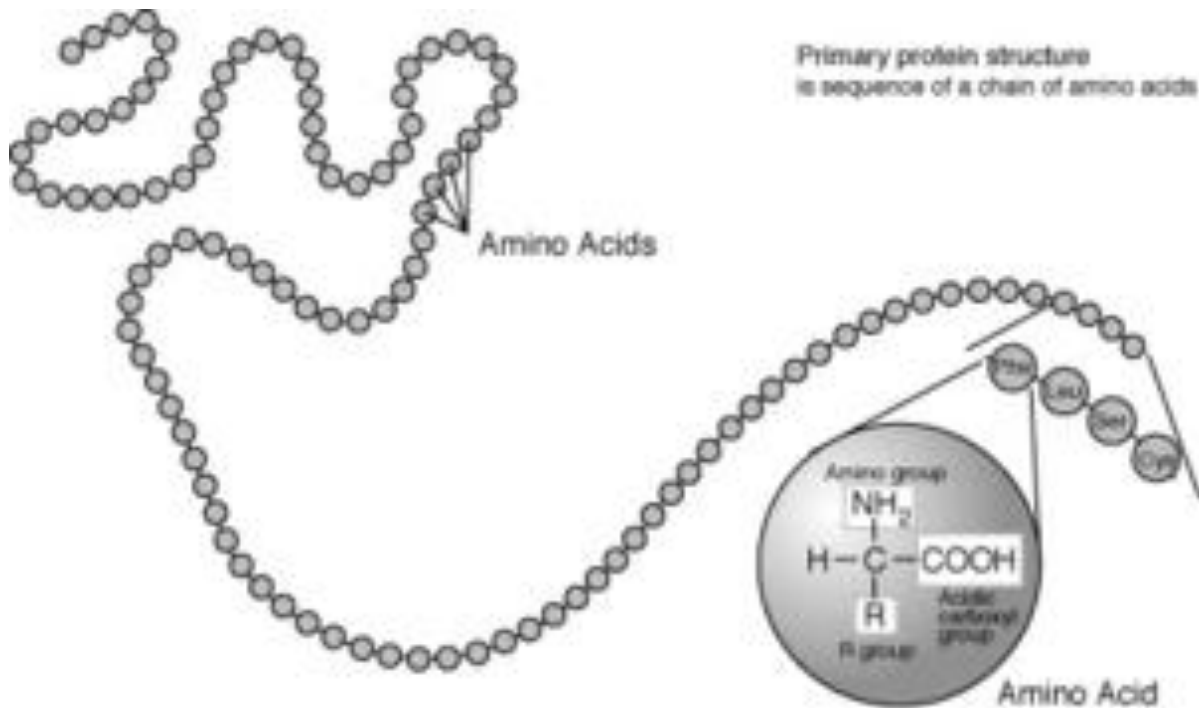


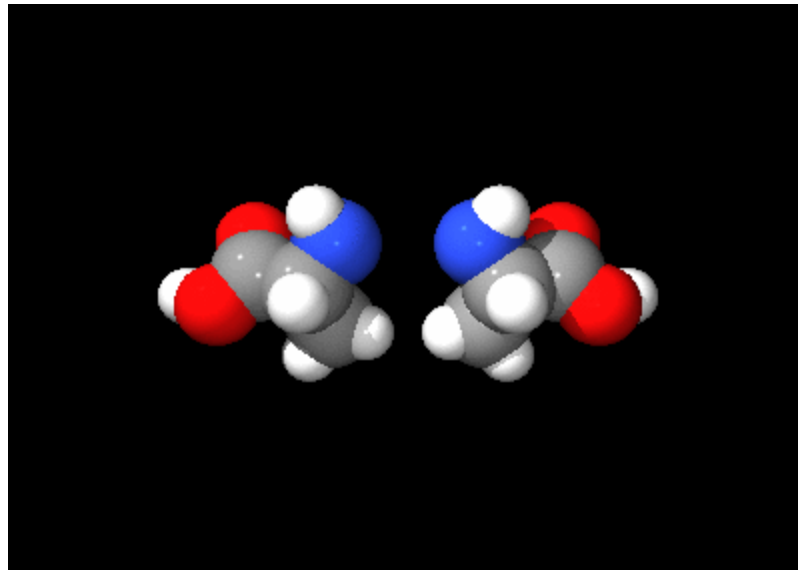
Schiff base  
(~ 20 Kcal/mol)

# Protonation – deprotonation equilibria



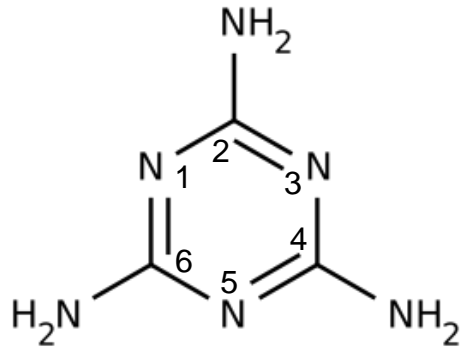
Aminoacid(s) Amino group(s)





D(+), L(-) Alanine

# 1,3,5-Triazine-2,4,6-triamine



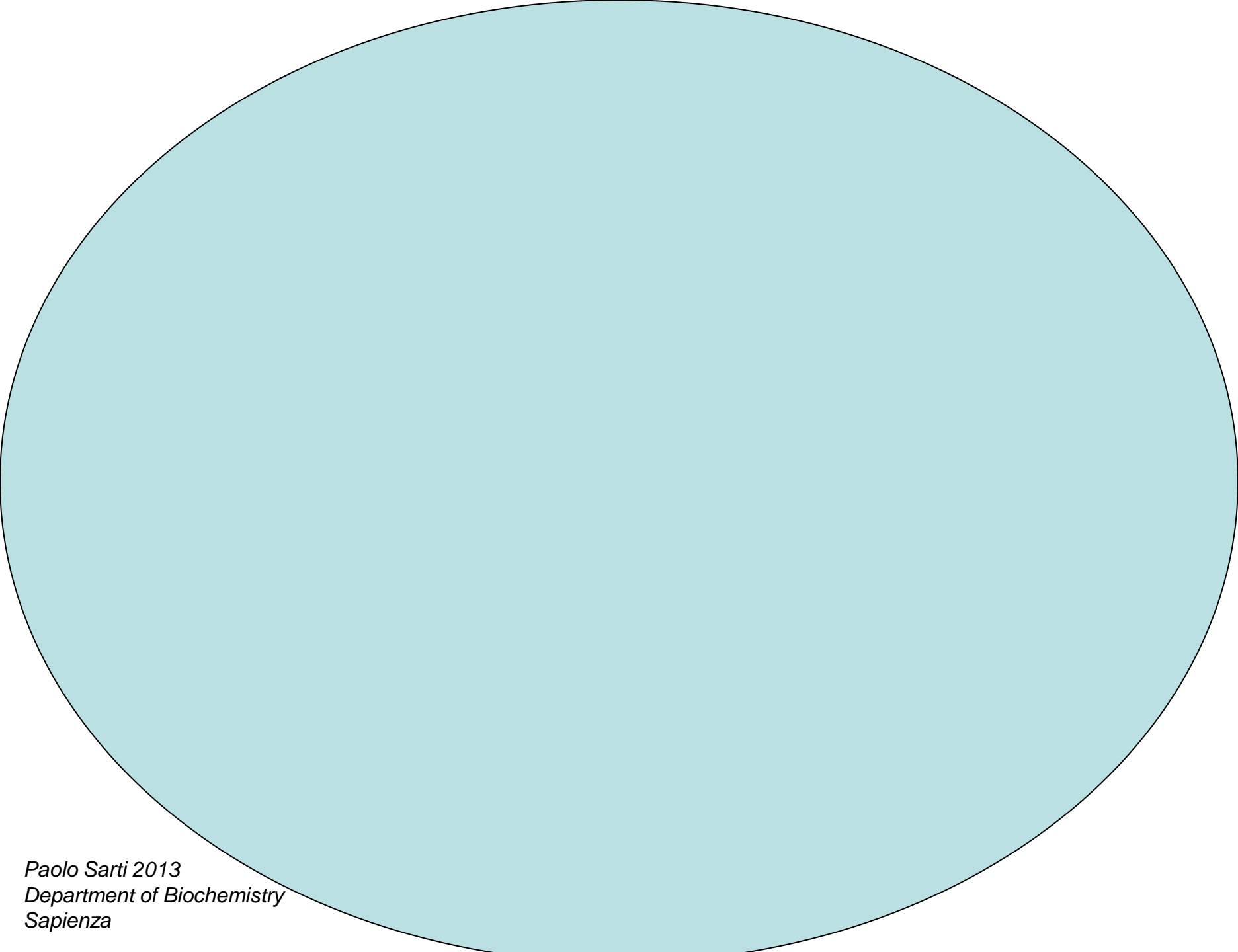
melamine



Milk sophistication (adulteration)... !!!



Melamine fibers (resins) (*chemical/thermal resistant surfaces, plastic, tetrapak etc.*)



*Paolo Sarti 2013  
Department of Biochemistry  
Sapienza*