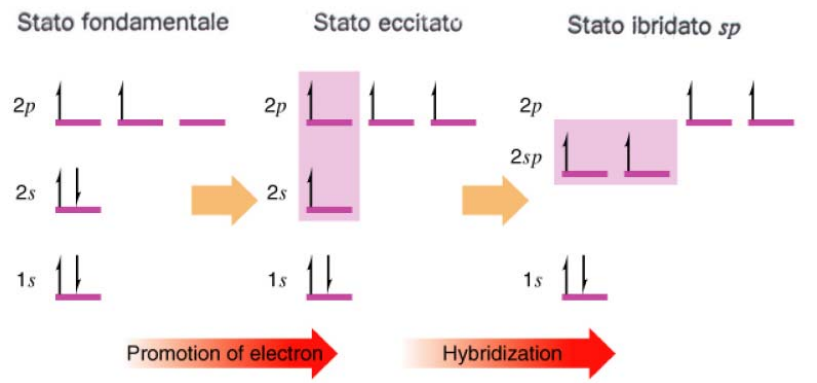
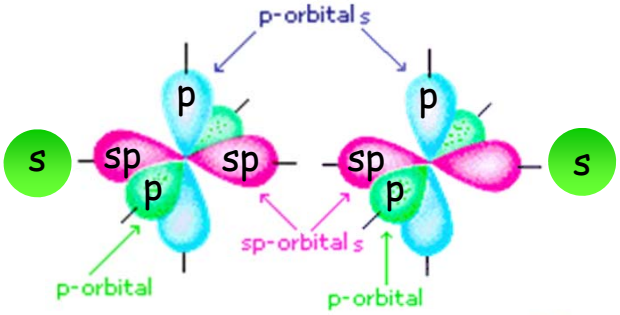
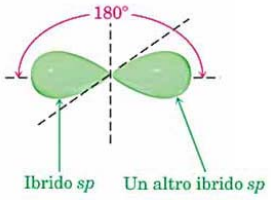
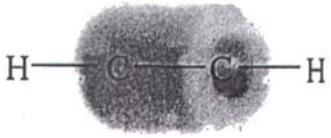
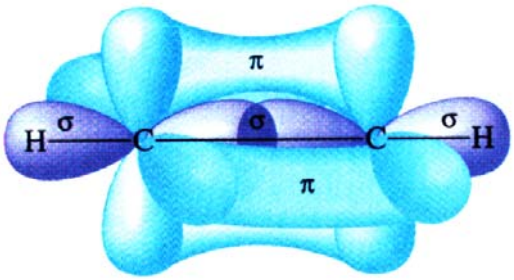
C sp ALCHINI

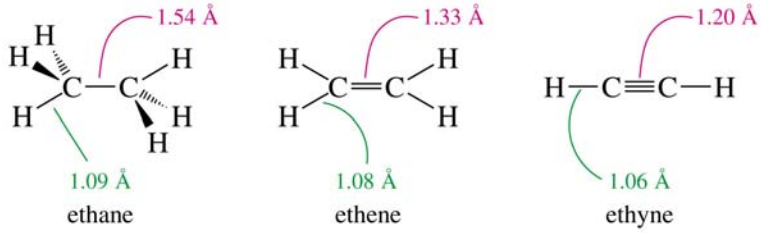

Stato fondamentale
Stato eccitato
Stato ibridato sp
2p
2s
1s
2sp
Promotion of electron
Hybridization


p-orbital
s
p
sp
sp-orbital
p-orbital


180°
Ibrido sp
Un altro ibrido sp


H
C
C
H


π
σ
H
C
C
H
π



Forza dei legami multipli C–C

legame	tipo	Lunghezza Å	Energia kcal	Energia kJ	Molecola misurata
C–C	sp^3-sp^3	1.54	83	347	CH_3CH_3
C=C	sp^2-sp^2	1.34	146	611	$CH_2=CH_2$
C≡C	sp - sp	1.20	200	837	HC≡CH

alcheni π 63 kcal/mol

alchini 2nd π 54 kcal/mol

carattere s

più corto

Legami σ tipici hanno energie di circa 80-120 kcal/mole

Legami π tipici hanno energie di circa 50-60 kcal/mole

Come per gli alcheni, gli alchini interni sostituiti sono più stabili di quelli esterni

More stable

NOMENCLATURA

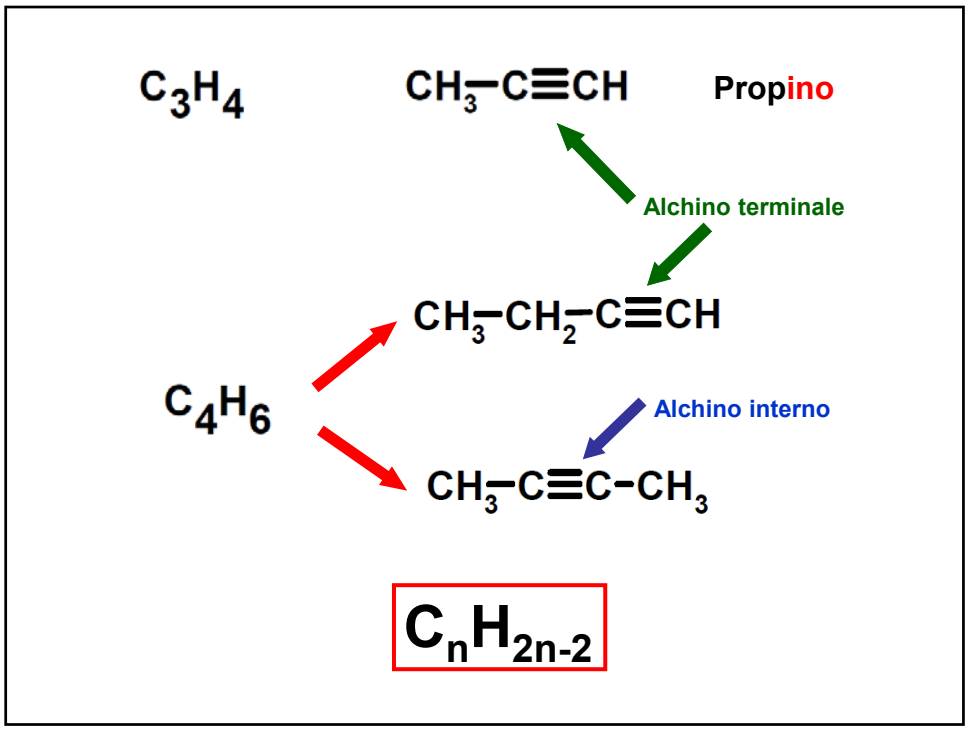
IUPAC:

alcano → alchino

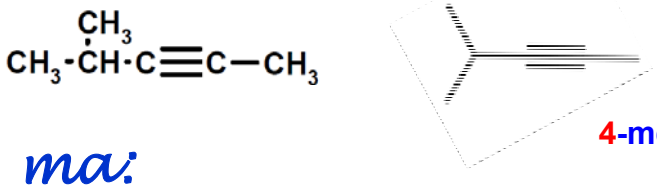
alchile → alchinile

C_2H_2 HC≡CH **Etino** (acetilene)

$C_2H_2+O_2$ 3030 °C



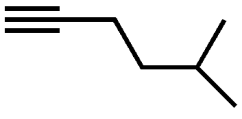
Agli atomi di carbonio del triplo legame vengono assegnati i numeri più bassi possibile

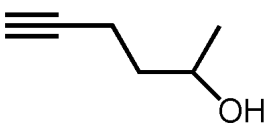


4-metil-2-pentino

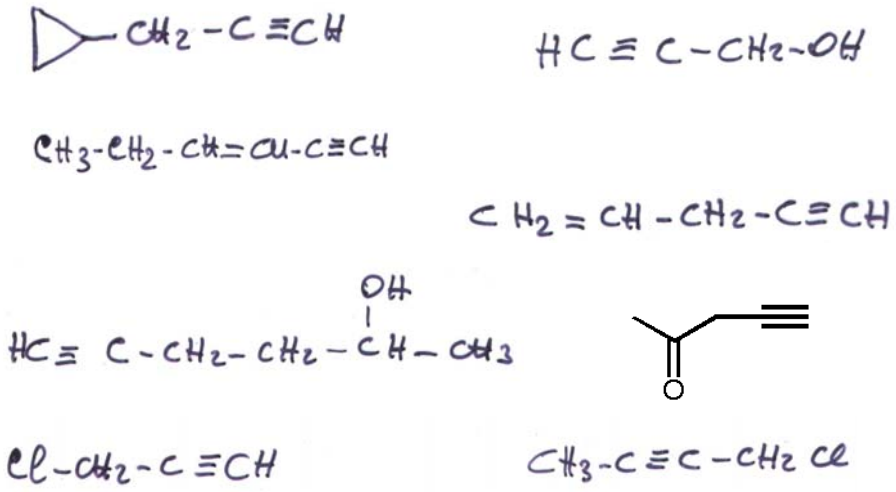
ma:

- **OH ha priorità**
- **NH_2 ha priorità**
- **il carbonile ha priorità**





Se nella catena principale ci sono legami doppi e tripli, la catena va numerata in modo da dare ai legami multipli i numeri più bassi possibile. A *parità di numerazione*, il numero più basso spetta al *doppio legame*.



Nome		pf (°C)	pe (°C, 1 atm)	Densità d^{20} (g mL^{-1})
Metano		−182	−161,5	
Etano		−183	−88,6	
Etene	$CH_2=CH_2$	−169	−104	0,384[a]
Etino	$HC\equiv CH$	−80,8	$-84,0^{760}_{(sub)}$	
Propano		−188	−42,1	
Propene	$CH_3CH=CH_2$	−185	−47	0,514
Propino	$CH_3C\equiv CH$	−101,51	−23,2	
Butano		−138	−0,5	
1-Butene	$CH_3CH_2CH=CH_2$	−185	−6,3	0,595
(*Z*)-2-Butene	$CH_3CH=CHCH_3$ (*cis*)	−139	3,7	0,621
(*E*)-2-Butene	$CH_3CH=CHCH_3$ (*trans*)	−106	0,9	0,604
1-Butino	$CH_3CH_2C\equiv CH$	−125,7	8,1	
2-Butino	$CH_3C\equiv CCH_3$	−32,3	27	

Nome	Formula	pf (°C)	pe (°C)	Densità d_4^{20} (g mL
Etino	$HC{\equiv}CH$	−80,8	$-84,0^{760}_{(sub)}$	
Propino	$CH_3C{\equiv}CH$	−101,51	−23,2	
1-Butino	$CH_3CH_2{\equiv}CH$	−125,7	8,1	
2-Butino	$CH_3C{\equiv}CCH_3$	−32,3	27	0,69
1-Pentino	$CH_3(CH_2)_2C{\equiv}CH$	−90	39,3	0,69
2-Pentino	$CH_3CH_2C{\equiv}CCH_3$	−101	55,5	0,71
1-Esino	$CH_3(CH_2)_3C{\equiv}CH$	−132	71	0,71
2-Esino	$CH_3(CH_2)_2C{\equiv}CCH_3$	−88	84	0,73
3-Esino	$CH_3CH_2C{\equiv}CCH_2CH_3$	−101	81,8	0,72

THE LONGEST CA INDEX NAME
(1,578 characters)

CAS Registry Number: 86417-45-0

$C_{601}H_{678}Br_2Cl_{18}N_{66}O_{184}P_{18}$

Adenosine, [(dimethylethyl)benzoyl](tetrahydromethoxypyranyl) adenylyl-(3'→5')-(dimethylphenyl)(tetrahydromethoxypyranyl) uridylyl-(3'→5')-(dimethylphenyl)(tetrahydromethoxypyranyl) uridylyl-(3'→5')-[(dimethylethyl)benzoyl] (tetrahydromethoxypyranyl)cytidylyl-(3'→5')-[(dimethylethyl) benzoyl](tetrahydromethoxypyranyl)cytidylyl-(3'→5')- [[(dimethylethyl)phenyl]acetyl](tetrahydromethoxypyranyl) guanylyl-(3'→5')-[[(dimethylethyl)phenyl]acetyl] (tetrahydromethoxypyranyl)guanylyl-(3'→5')-[(dimethylethyl) benzoyl](tetrahydromethoxypyranyl)adenylyl-(3'→5')- [(dimethylethyl)benzoyl](tetrahydromethoxypyranyl)cytidylyl- (3'→5')-(dimethylphenyl)(tetrahydromethoxypyranyl)uridylyl- (3'→5')-(dimethylphenyl)(tetrahydromethoxypyranyl)uridylyl- (3'→5')-[[(dimethylethyl)phenyl]acetyl] (tetrahydromethoxypyranyl)guanylyl-(3'→5')-(dimethylphenyl) (tetrahydromethoxypyranyl)uridylyl-(3'→5')-[(dimethylethyl) benzoyl](tetrahydromethoxypyranyl)cytidylyl-(3'→5')- [(dimethylethyl)benzoyl](tetrahydromethoxypyranyl)cytidylyl- (3'→5')-[(dimethylethyl)benzoyl](tetrahydromethoxypyranyl) adenylyl-(3'→5')-[(dimethylethyl)benzoyl] (tetrahydromethoxypyranyl)cytidylyl-(3'→5')-[(dimethylethyl) benzoyl](tetrahydromethoxypyranyl)cytidylyl-(3'→5')- [(dimethylethyl)benzoyl](methoxymethylene)-, octadecakis(2-chlorophenyl) ester, 5'-[2-(dibromomethyl)benzoate] (9CI)

Synthesized yeast alanine tRNA

(1983)

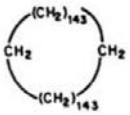
THE LONGEST ALIPHATIC CHAIN (384 carbons)

$CH_3—(CH_2)_{382}—CH_3$ Tetraoctacontatrictane

$C_{384}H_{770}$

CA 102:185585k (1985)

THE LARGEST SINGLE-RING PARENT (288 carbons)

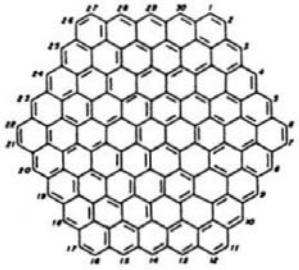


Cyclooctaoctacontadictane

$C_{288}H_{576}$

CA 89:179585g (1978)

THE LARGEST RING SYSTEM (61 rings)



$C_{150}H_{30}$

CA 102:112511y (1985)

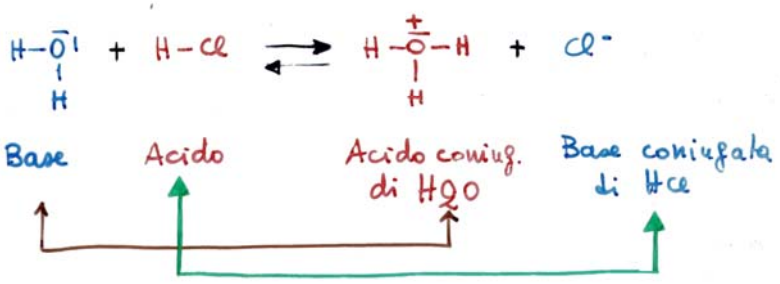
Acidità e Basicità

delle molecole organiche

① Brousted - Lowry

Acido: sostanza in grado di donare un protone

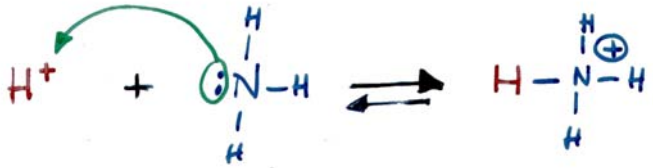
Base: sostanza in grado di accettare un protone



② Lewis

Acido: accetta una coppia di e^-

Base: dona una coppia di e^-



ACIDO:

$$HA + H_2O \rightleftharpoons H_3O^+ + A^-$$

acido base Ac. coniug. Base con.

$$K = \frac{[H_3O^+][A^-]}{[HA]\cancel{[H_2O]}} \quad \text{cost.}$$

$$K_A = K[H_2O] = \frac{[H_3O^+][A^-]}{[HA]} \quad mol\ L^{-1}$$

$$pK_a = -\log K_a$$

BASE: $A^- + H_2O \rightleftharpoons HA + OH^-$

$$K = \frac{[HA][OH^-]}{[A^-][H_2O]}$$

$$K_B = K'[H_2O] = \frac{[HA][OH^-]}{[A^-]} \quad mol\ L^{-1}$$

$$\boxed{pK_b = -\log K_b}$$

$$K_a \times K_B = \frac{[H_3O^+][A^-]}{[HA]} \times \frac{[HA][OH^-]}{[A^-]} = [H_3O^+][OH^-] = K_w = 10^{-14}$$

$$\boxed{pK_a + pK_b = 14}$$

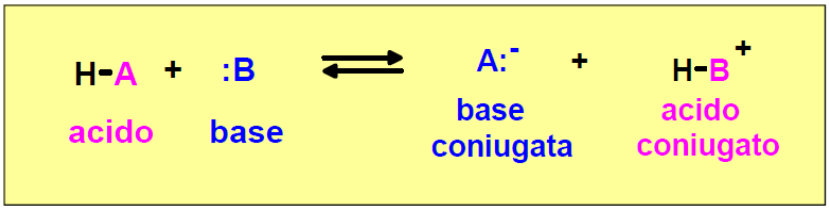
CH_3COOH $\quad K_a = 2 \times 10^{-5}$ $\quad pK_a = 4.7$

$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$

Acido debole — Base debole — Base forte — Acido forte

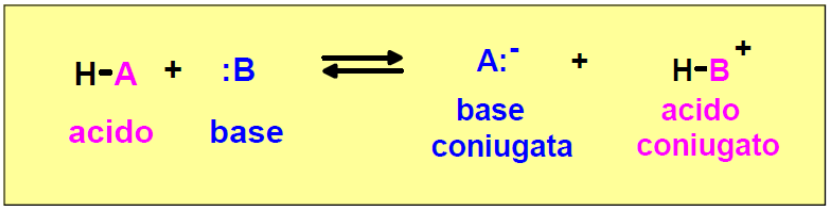
$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$

$$pK_b = 14 - 4.7 = 9.3$$



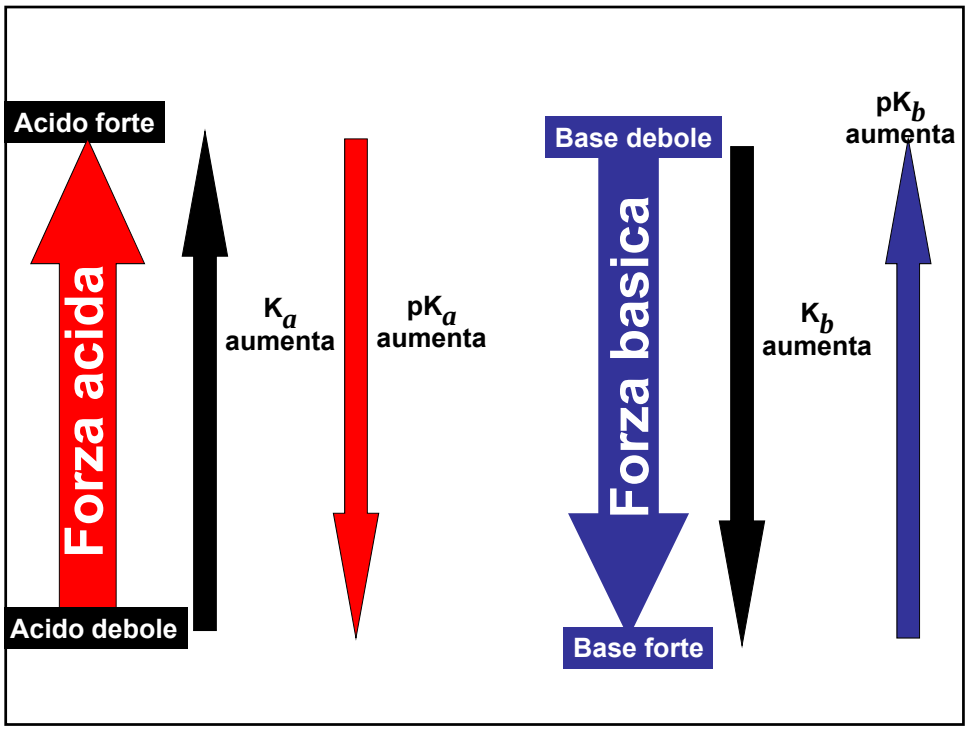
forte → debole

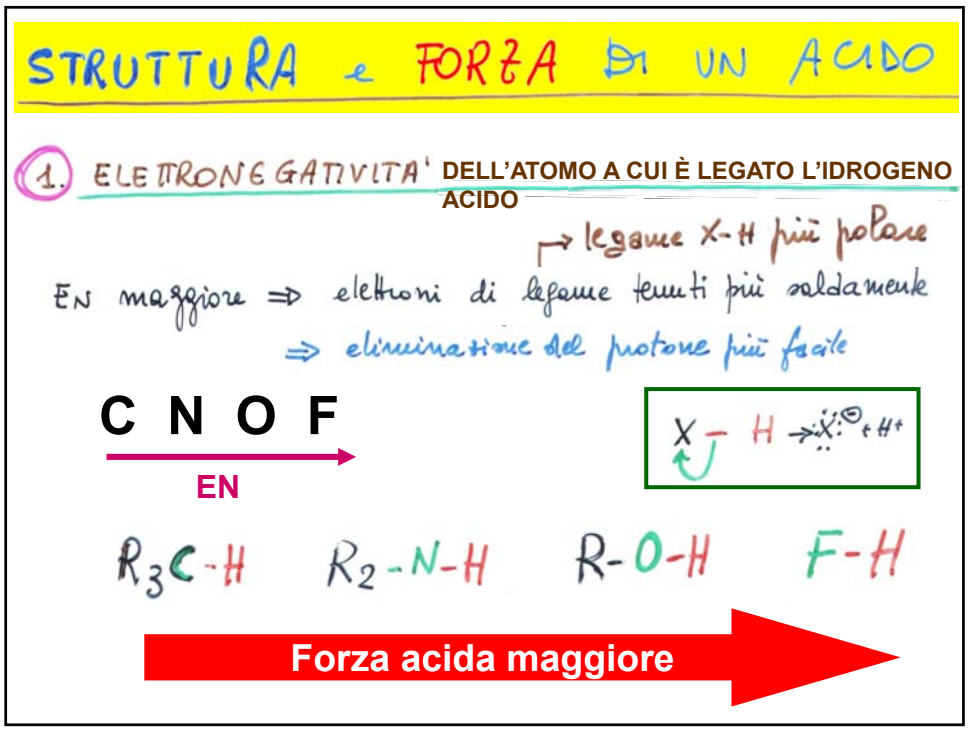
debole → forte



forte → debole

debole → forte


Acido forte
Forza acida
Acido debole
K_a aumenta
pK_a aumenta
Base debole
Forza basica
Base forte
K_b aumenta
pK_b aumenta


STRUTTURA e FORZA DI UN ACIDO
1. ELETTRONEGATIVITA' DELL'ATOMO A CUI È LEGATO L'IDROGENO
ACIDO
legame X-H più polare
EN maggiore ⇒ elettroni di legame tenuti più saldamente
⇒ eliminazione del protone più facile
C N O F
EN
X – H → X: + H+
R3C-H
R2-N-H
R-O-H
F-H
Forza acida maggiore

2. DIMENSIONE DELL'ATOMO A CUI È LEGATO L'IDROGENO ACIDO

$HA + H_2O \rightleftharpoons A^- + H_3O^+$

Un atomo più grande disperde meglio la carica negativa ⇒ maggiore stabilizzazione della base coniugata → Acido più forte

Forza legame HX

VI	VII	pK_a
O	F	3.45
S	Cl	−7
Se	Br	−9
	I	−9.5

EN aumenta

DIMENSIONE AUMENTA

ACIDITÀ' AUMENTA

3. IBRIDAZIONE

C sp^3 sp^2 sp

aumenta il carattere "s" dell'orbit. ibrido

e⁻ più vicini al nucleo ⇒ EN maggiore

aumento di polarità del legame C – H

forza acida crescente

3. IBRIDAZIONE

sp^3 sp^2 sp

CH_3-CH_2-H $H_2C=CH$ (H) $HC\equiv C-H$

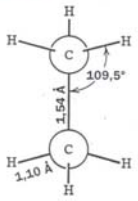
pka ~50 ~44 ~25

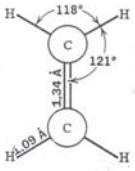
→ forza acida crescente

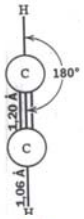
$CH_3CH_2^{\ominus}$ $CH_2=CH^{\ominus}$ $HC\equiv C^{\ominus}$

← basicità crescente

3. IBRIDAZIONE







H_3C-CH_3 $H_2C=CH_2$ $HC\equiv CH$

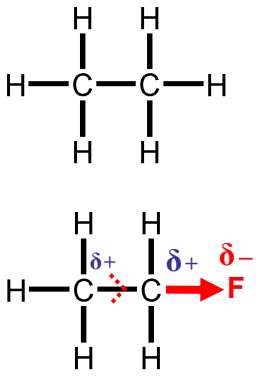
sp^3 sp^2 sp

pka 50 44 25

gli alchini terminali sono acidi.

H_2O: pKa 15.7 ROH: pKa ~15-18

4. Effetto induttivo



L'effetto induttivo si trasmette attraverso lo spazio e attraverso i legami

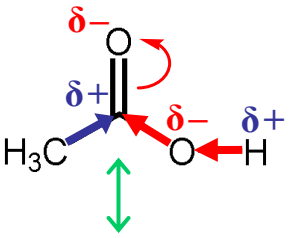
EFFETTO INDUTTIVO

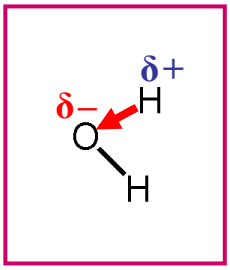
+I SOSTITUENTI ELETTRON DONATORI

-I SOSTITUENTI ELETTRON ATTRATTORI

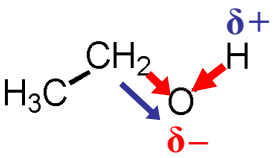
4. Effetto induttivo

I gruppi alchilici **hanno un effetto induttivo elettron donatore, anche se piccolo**





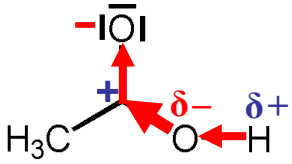
pK$_a$ 15.7



Acido più debole

pK$_a$ 15.9

ALCOL



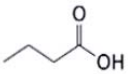
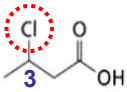
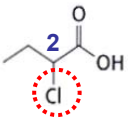
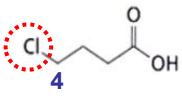
Acido più forte

pK$_a$ 4.75

ACIDO CARBOSSILICO

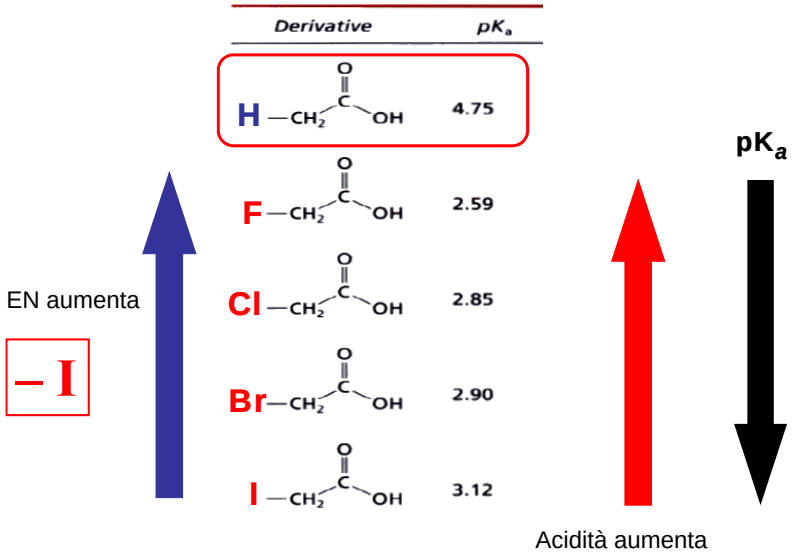
Gruppi elettron attrattori aumentano l'acidità ↓ pK$_a$

L'effetto induttivo si trasmette attraverso lo spazio

Compound	pK$_a$	Compound	pK$_a$
	4.81		4.05
	2.86		4.52

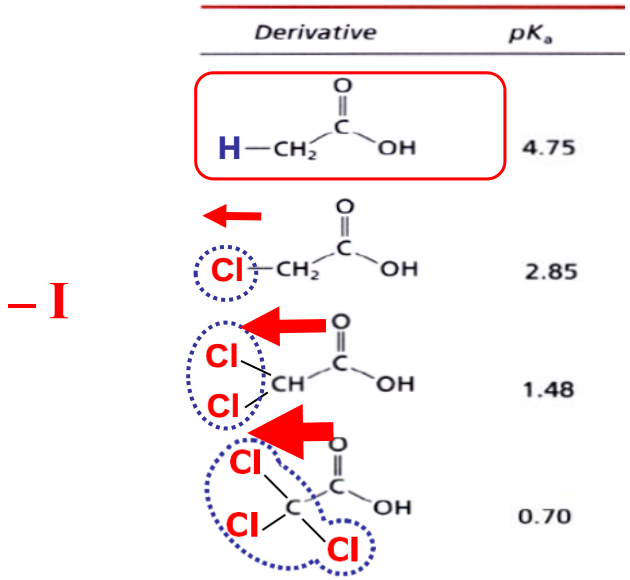
Gruppi elettron attrattori aumentano l'acidità ↓ pK_a

L'effetto induttivo dipende anche dall'elettronegatività dell'atomo



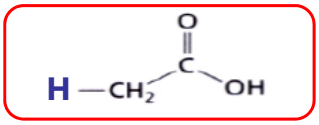
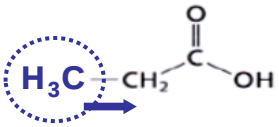
Gruppi elettron attrattori aumentano l'acidità ↓ pK_a

L'effetto induttivo è ADDITIVO



Gruppi elettron donatori diminuiscono l'acidità ↑ pK_a

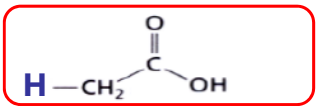
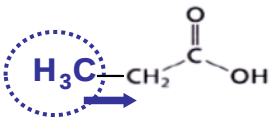
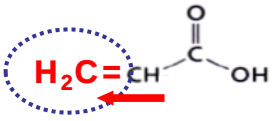
I gruppi alchilici hanno un effetto induttivo elettron donatore, anche se piccolo

Derivative	pK_a
	4.75
+ I 	4.87

Gruppi elettron attrattori aumentano l'acidità ↓

Gruppi elettron donatori diminuiscono l'acidità ↑ pK_a

L'effetto induttivo dipende anche dall'ibridazione dell'atomo

Derivative	pK_a
	4.75
+ I 	4.87
– I 	4.35

Gruppi elettron attrattori aumentano l'acidità

Gruppi elettron donatori diminuiscono l'acidità

pK_a

	Composto	pK_a	
	H_2O	15,7	
+I	CH_3OH	15,5	
+I	CH_3CH_2OH	15,9	1 gruppo alchilico
+I	$(CH_3)_2CHOH$	17,1	2 gruppi alchilici
+I	$(CH_3)_3COH$	18	3 gruppi alchilici
−I	$ClCH_2CH_2OH$	14,3	1 Cl in β
−I	CF_3CH_2OH	12,4	3 F in β
−I	$CF_3CH_2CH_2OH$	14,6	3 F in γ
−I	$CF_3CH_2CH_2CH_2OH$	15,4	3 F in δ

EFFETTO MESOMERICO

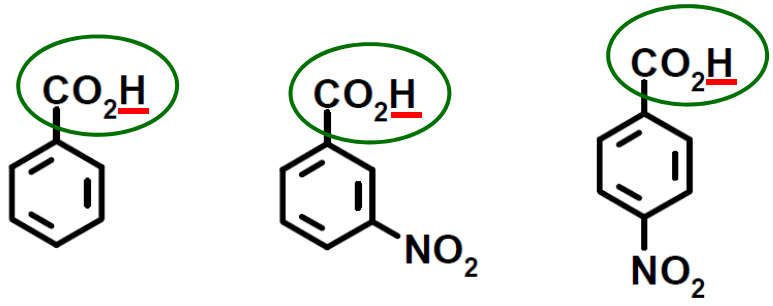
effetto mesomero / coniugativo / di risonanza

Riguarda quei sostituenti che possono provocare *una delocalizzazione elettronica a causa della risonanza, modificando così la densità elettronica*.

+R SOSTITUENTI ELETTRON DONATORI

-R SOSTITUENTI ELETTRON ATTRATTORI

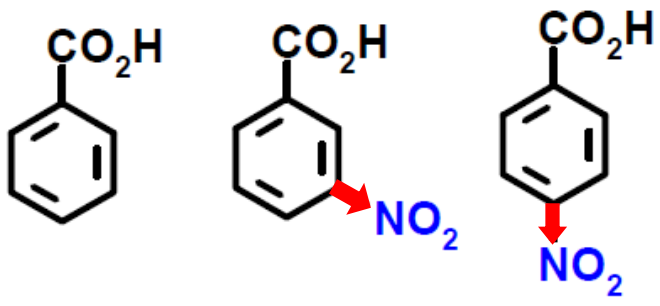
L'effetto coniugativo si aggiunge all'effetto induttivo



1. l'idrogeno acido è lo stesso

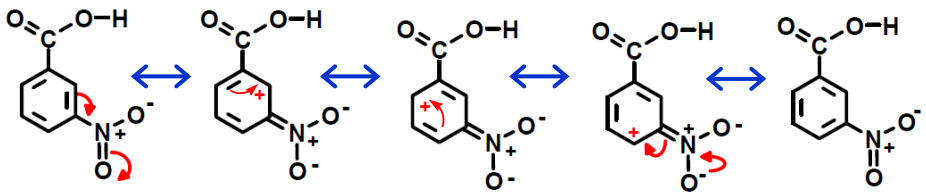
2. legato allo stesso gruppo funzionale

EFFETTO INDUTTIVO

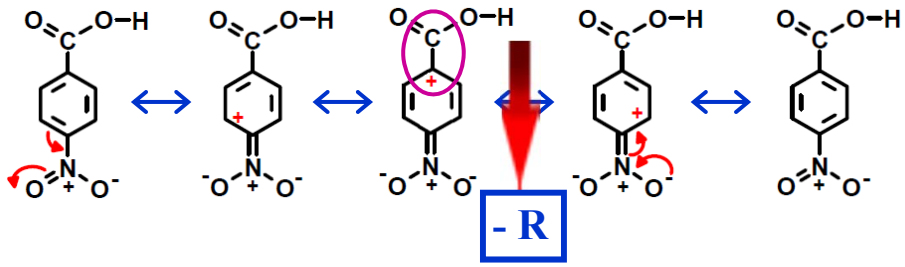


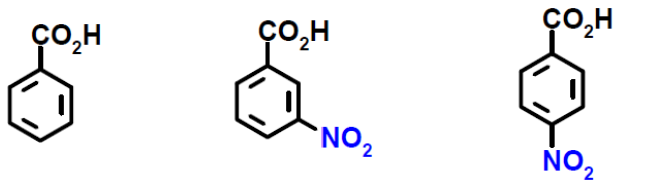
-I -I

EFFETTO MESOMERICO



La risonanza non interessa mai il carbossile R = 0





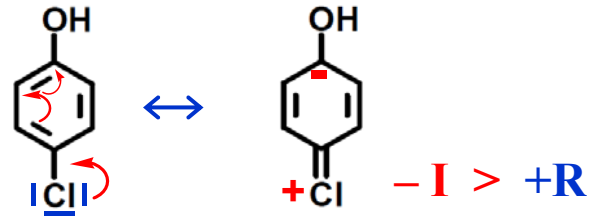
pKa	4.2	3.5	3.4

quando l'atomo responsabile dell'effetto -I,+R è azoto o ossigeno

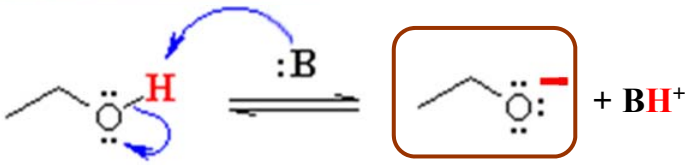
N, O ⇒ |+R| > |–I| effetto complessivo a rilascio elettronico

quando l'atomo responsabile dell'effetto -I,+R è un alogeno

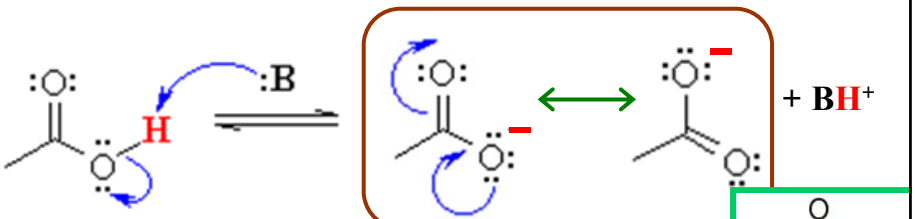
F, Cl, Br, I ⇒ |–I| > |+R| effetto complessivo ad attrazione elettronica



5. Risonanza

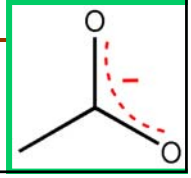


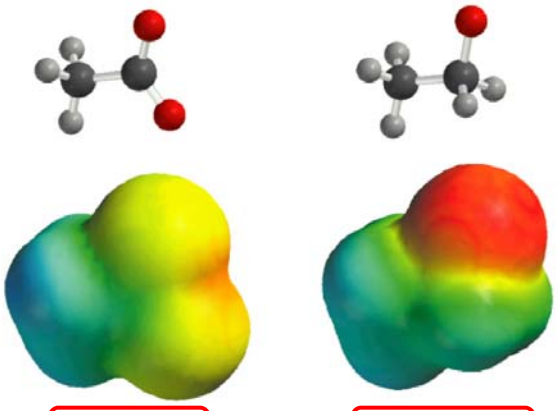
Alcol $pK_a = 16$ Anione alcossido



Acido carbossilico $pK_a = 5$

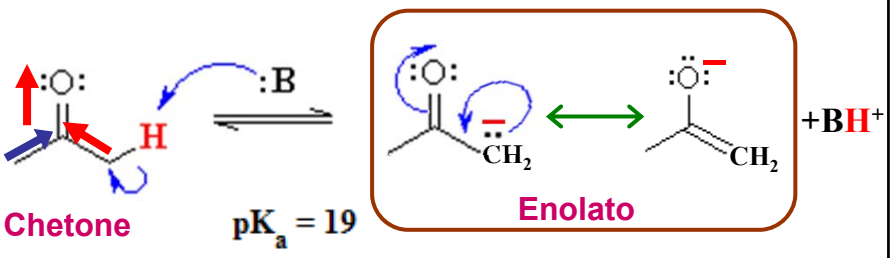
Anione carbossilato

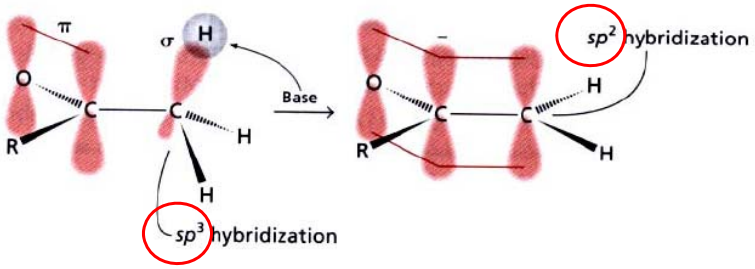




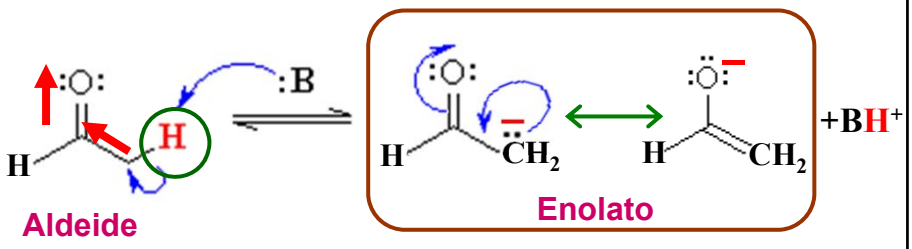
Calculated electrostatic potential maps for acetate anion and ethoxide anion. Although both molecules carry the same –1 net charge, acetate stabilizes the charge better by dispersing it over both oxygens.

Acidità degli idrogeni in α di aldeidi e chetoni



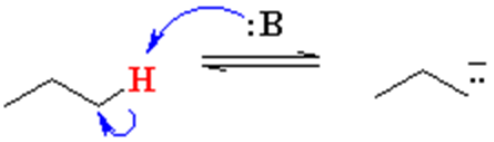


Acidità degli idrogeni in α di aldeidi e chetoni



Aldeide

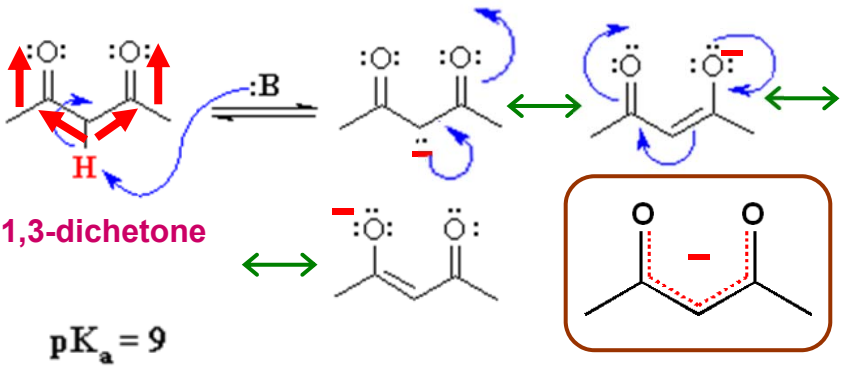
pKa = 17



Alcano

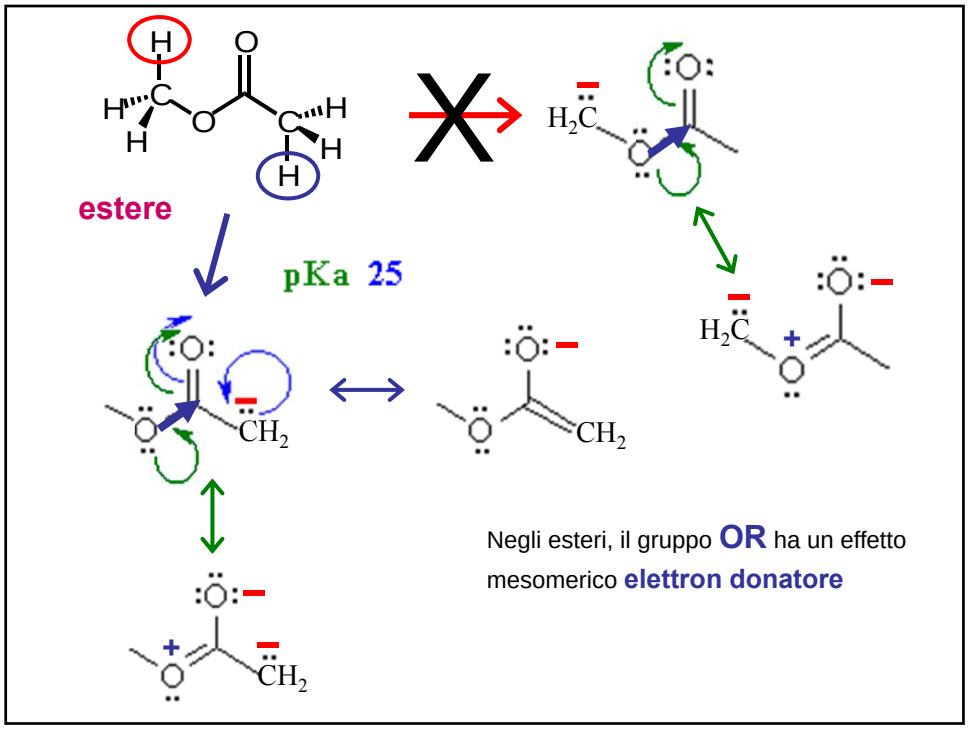
$pK_a \approx 50$

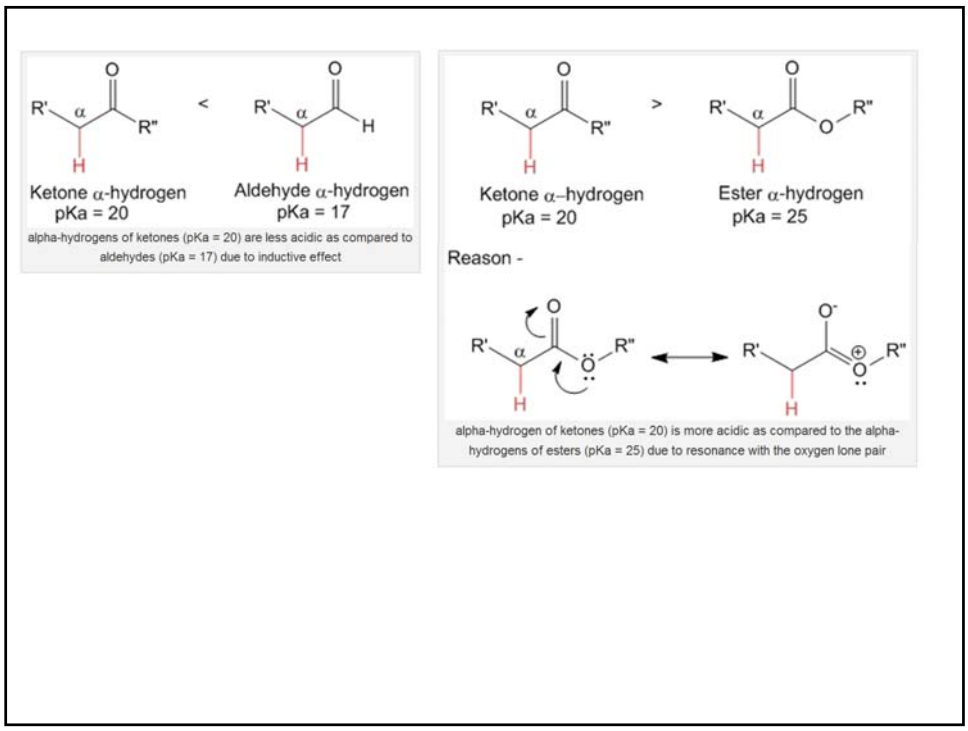
Carbanione

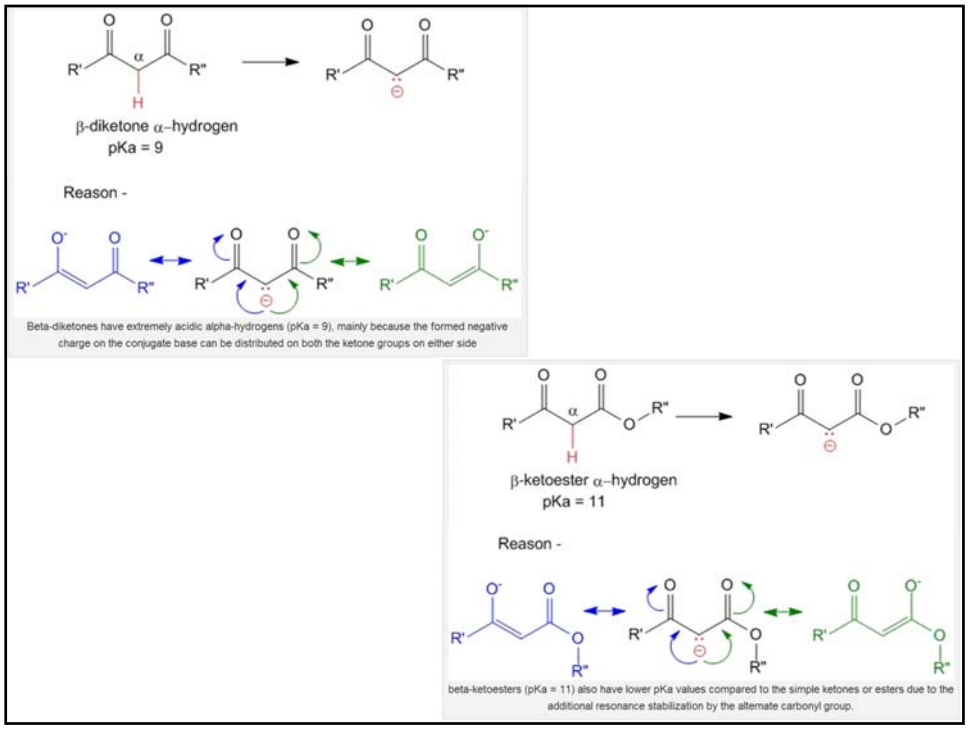


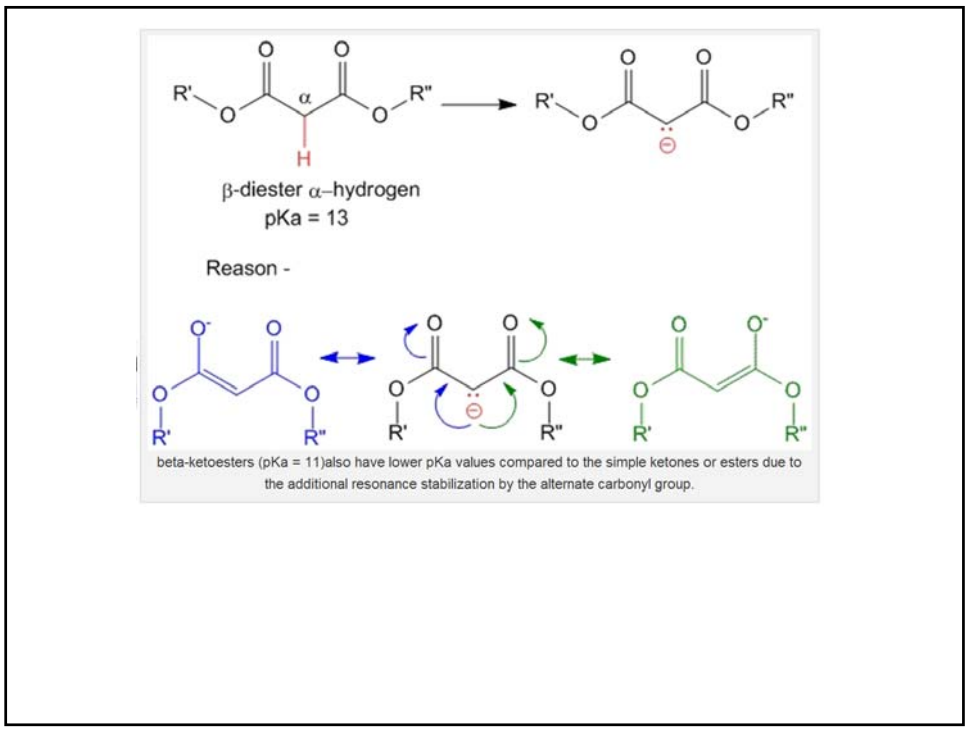
1,3-dichetone

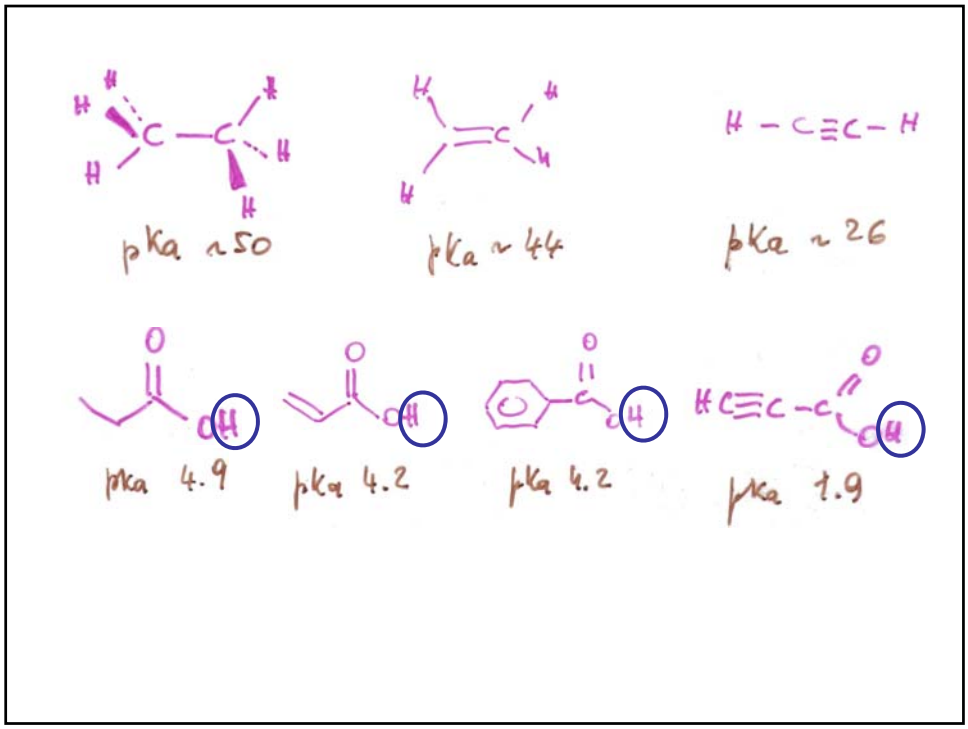
$pK_a = 9$

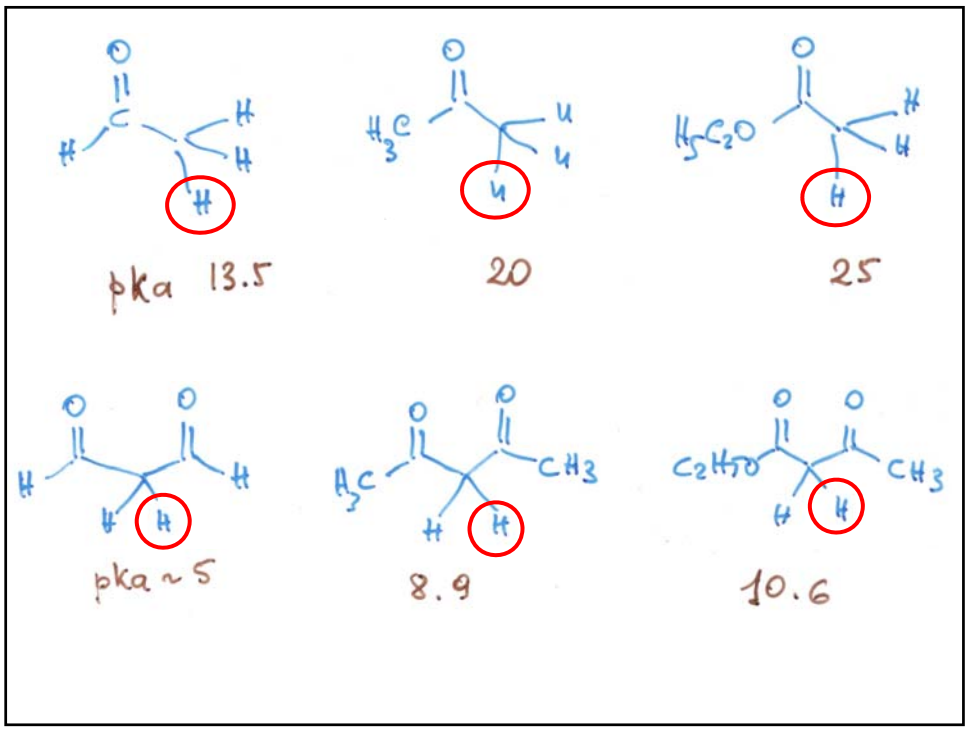

estere
pKa 25
Negli esteri, il gruppo OR ha un effetto mesomerico elettron donatore


Ketone α-hydrogen
pKa = 20
Aldehyde α-hydrogen
pKa = 17
alpha-hydrogens of ketones (pKa = 20) are less acidic as compared to aldehydes (pKa = 17) due to inductive effect
Ketone α–hydrogen
pKa = 20
Ester α-hydrogen
pKa = 25
Reason -
alpha-hydrogen of ketones (pKa = 20) is more acidic as compared to the alpha-hydrogens of esters (pKa = 25) due to resonance with the oxygen lone pair

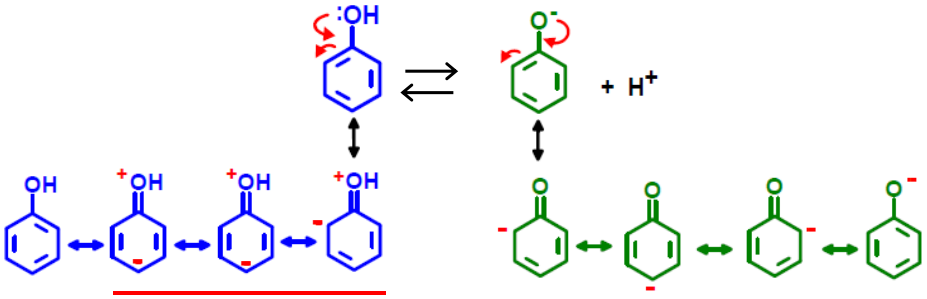

β-diketone α–hydrogen
pKa = 9
Reason -
Beta-diketones have extremely acidic alpha-hydrogens (pKa = 9), mainly because the formed negative charge on the conjugate base can be distributed on both the ketone groups on either side
β-ketoester α–hydrogen
pKa = 11
Reason -
beta-ketoesters (pKa = 11) also have lower pKa values compared to the simple ketones or esters due to the additional resonance stabilization by the alternate carbonyl group.


β-diester α–hydrogen
pKa = 13
Reason -
beta-ketoesters (pKa = 11)also have lower pKa values compared to the simple ketones or esters due to the additional resonance stabilization by the alternate carbonyl group.

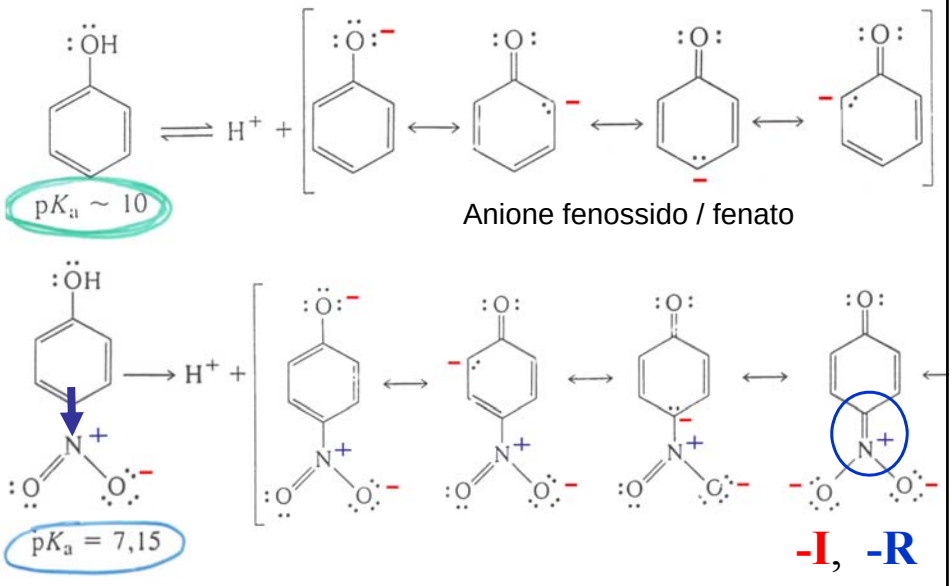

pKa ~50
pKa ~44
H – C≡C – H
pKa ~26
pKa 4.9
pKa 4.2
pKa 4.2
pKa 1.9

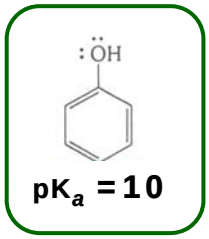

pKa 13.5
20
25
pKa ~5
8.9
10.6

ACIDITÀ DEI FENOLI

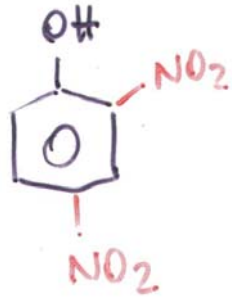


ACIDITÀ DEI FENOLI

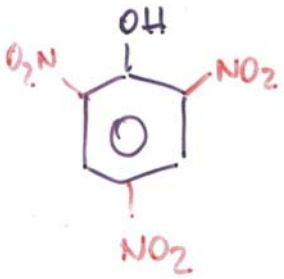




$pK_a = 10$



$pK_a = 3.96$

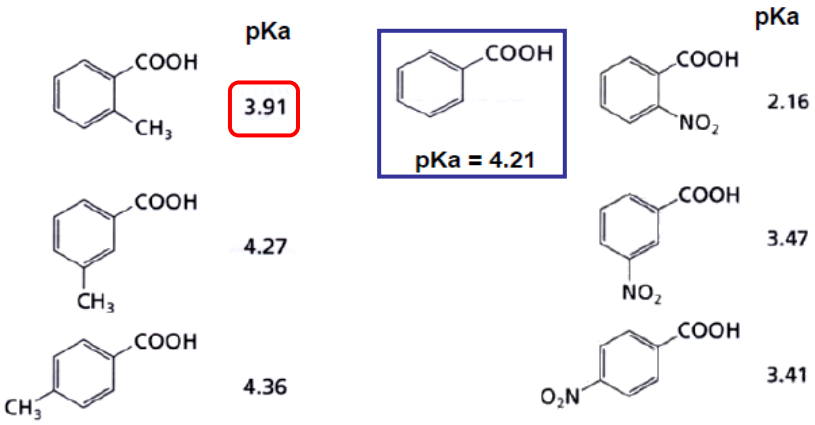


Acido picrico

$pK_a = 0.3$

$pK_a = 10.17$

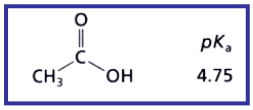
Acidi benzoici. Effetto orto

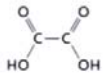
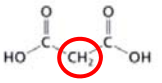
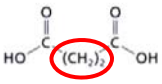
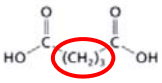
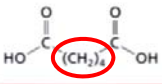


An **ortho-substituted acid** is **more acidic** than the meta or para-substituted form.

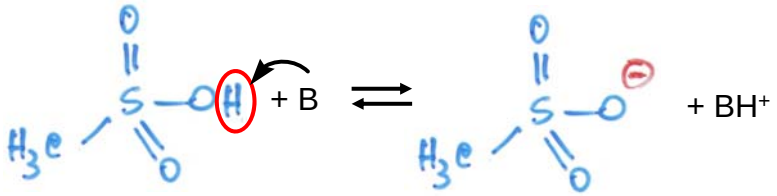
This effect is not dependent on the nature of the substituent (e^- donating or e^- withdrawing).
The reason for this is that the **steric hinderance** between the substituent and the neighboring carboxylate forces the carboxylate **to bend out of the plane of the aromatic ring**. **This eliminates resonance** (conjugative electron donation) **which requires a coplanar relationship**.
This conformational shift alters the delocalization of the charge into the benzene ring, making it easier for the negative charge to be delocalized throughout the pi-system.

Acidi dicarbossilici

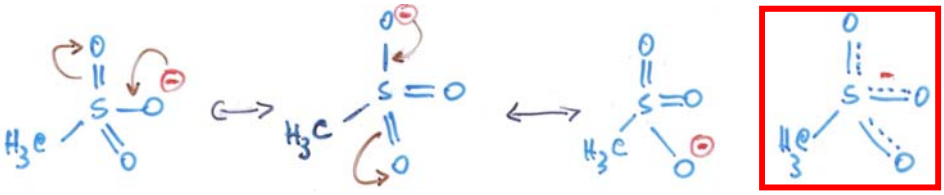


Compound	Name	pK_1	pK_2
	Oxalic acid	1.23	4.19
	Malonic acid	2.83	5.69
	Succinic acid	4.16	5.61
	Glutaric acid	4.34	5.41
	Adipic acid	4.43	5.41

Gli acidi solfonici

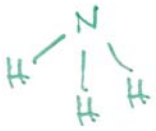


acido metansolfonico

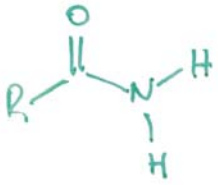


pK_a = -2

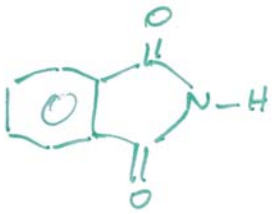
Acidi contenenti gruppi NH



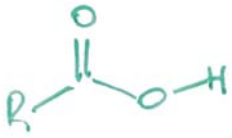
pKa 33



pKa 17



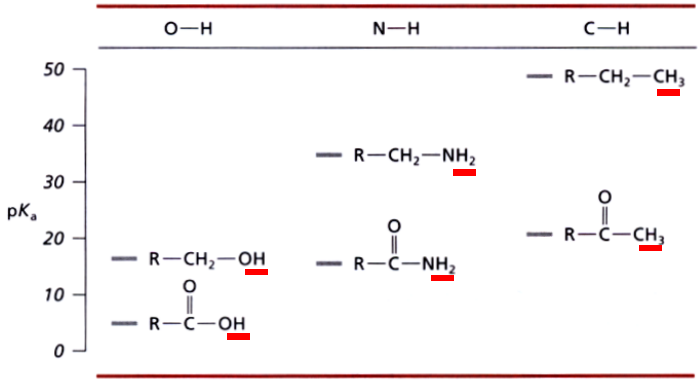
pKa 8.3



pKa 5

EN

C	N	O
2.5	3.04	3.44



Valori del pK_a di vari acidi carbossilici e di altri acidi

Composto	pK_a
Acidi alcanoici	
CH_3COOH	4,74
$CH_3CH_2CH_2COOH$	4,9
$ClCH_2COOH$	2,86
$CH_3CH_2CHClCOOH$	2,8
$CH_3CHClCH_2COOH$	4,1
$ClCH_2CH_2CH_2COOH$	4,5
$Cl_2CHCOOH$	1,26
Cl_3CCOOH	0,64
F_3CCOOH	0,23
Acidi dioici	
$HOOCCOOH$	1,23; 4,19
$HOOCCH_2COOH$	2,83; 5,69
$HOOCCH_2CH_2COOH$	4,16; 5,61
$HOOC(CH_2)_4COOH$	4,43; 5,41
Acidi benzoici	
C_6H_5COOH	4,19
$4\text{-}CH_3C_6H_4COOH$	4,36
$4\text{-}ClC_6H_4COOH$	3,98
Altri acidi	
H_3PO_4	2,15 (pK_a primario)
HNO_3	−1,3
HCl	−2,2
H_2SO_4	−5,2 (pK_a primario)
H_2O	15,7
CH_3OH	15,5

pKa

Acido $R\text{-}SO_2OH$ > RCO_2H > $ArOH$ > ROH >

~pKa 0 > 5 > 10 > 15 >

RNH_2 > RCH_3

35 > 50

		pKa
carboxylic acid	HO–C(=O)–R	5
nitro	CH_3-NO_2	9
amide	H_2N–C(=O)–R	15
aldehyde	CH_3–C(=O)–H	17
ketone	CH_3–C(=O)–R	20
ester	CH_3–C(=O)–OR	25
nitrile	CH_3-CN	25
amide	CH_3–C(=O)-$N(CH_3)_2$	30
alkane	CH_3-CH_3	~50

BASICITA'

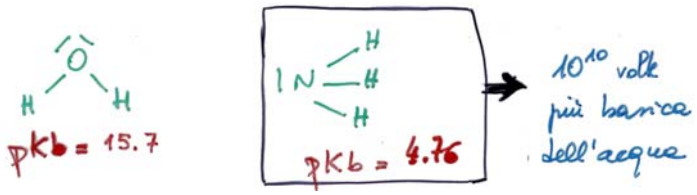
base:
- accetta un protone
- dona un doppietto di e^-

→ più accessibili sono gli elettroni, più forte è la base

→ più è stabile l'acido coniugato più forte è la base

(A) effetto del doppietto non condiviso:

- Un doppietto e⁻ non condiviso è più facilmente accessibile se è su un elemento meno elettronegativo:



$$B + H_2O \rightleftharpoons BH^+ + OH^-$$

$$K_b = \frac{[BH^+][OH^-]}{[B]}$$

Effetti che diminuiscono la densità elettronica sull'azoto:

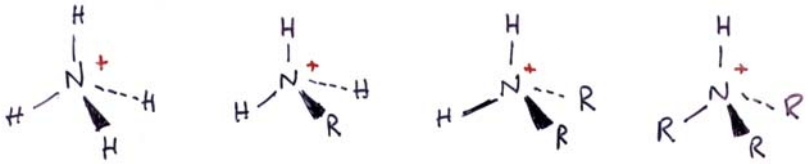
- l'azoto è legato a un gruppo e⁻ attrattore
- il doppietto è in un orbitale sp o sp^2
- il doppietto è coniugato con un gruppo e⁻-attrattore
- il doppietto è coinvolto nel mantenere l'aromaticità della molecola

⇒ il doppietto è meno disponibile per la protonazione ⇒ l'ammina è una base più debole.

pKb

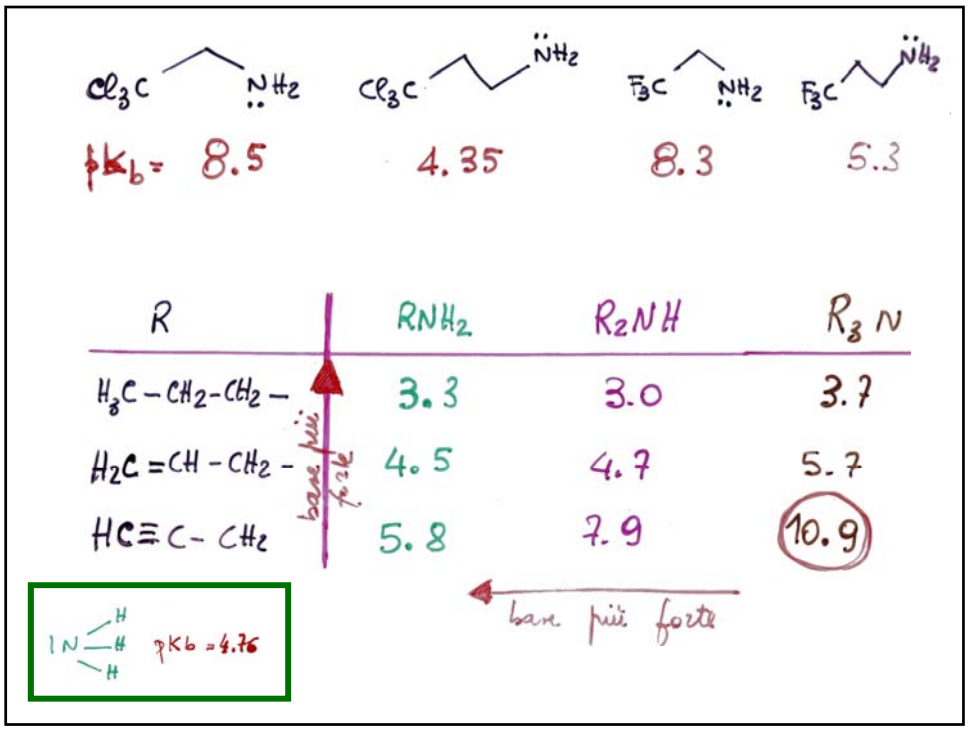
R	RNH_2	R_2NH	R_3N	
Me	3.4	3.2	4.2	
Et	3.3	3.0	3.2	
n-Pr	3.3	3.0	3.7	
n-Bu	3.3	2.7	4.1	
H			4.8	NH_3

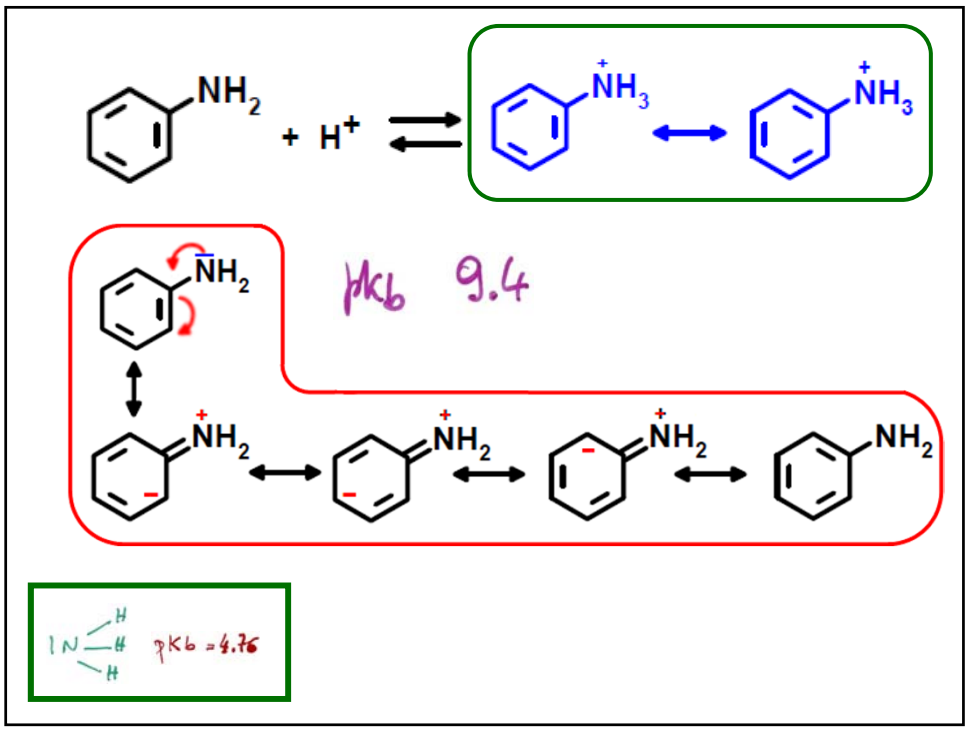
B STABILIZZAZIONE DELL'ACIDO CONIUGATO

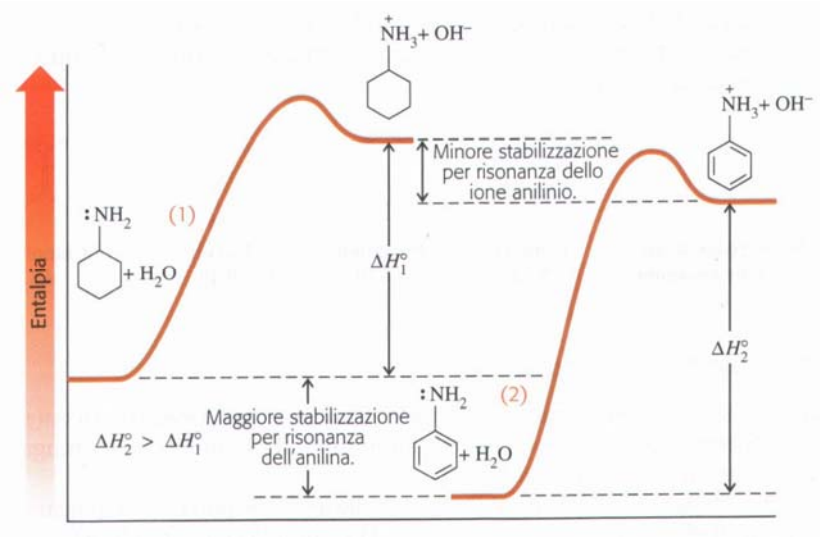


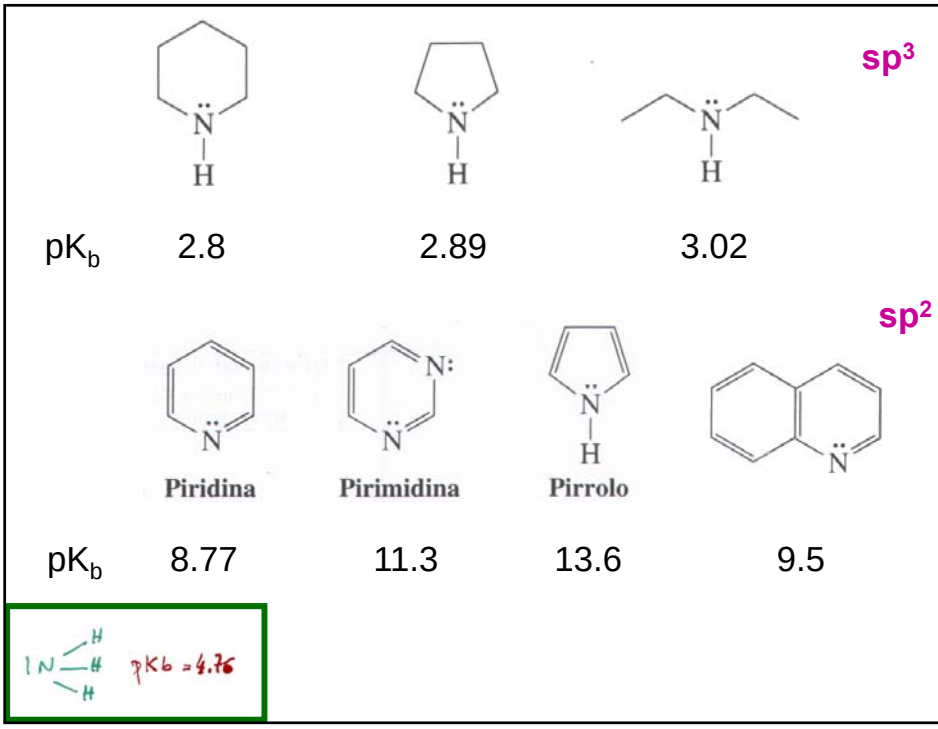
stabilizz. della carica ⊕ da parte del gruppo alchilico

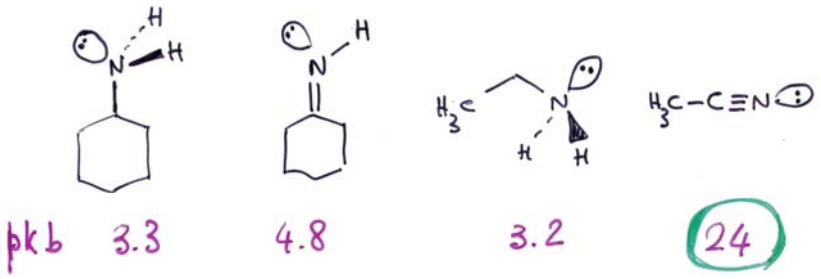
stabilizz. della carica ⊕ dal legame a idrogeno con il solvente ⇒ maggior leg. a H ⇒ maggior stabilizz.


pKb = 8.5
4.35
8.3
5.3
R
RNH2
R2NH
R3N
H3C – CH2 – CH2 –
3.3
3.0
3.7
H2C = CH – CH2 –
4.5
4.7
5.7
HC ≡ C – CH2
5.8
7.9
10.9
base più forte
base più forte
pKb = 4.76


NH2
+ H+
NH3
NH3
NH2
pKb 9.4
NH2
NH2
NH2
NH2
pKb = 4.76


$NH_3^+ + OH^-$
Entalpia
$:NH_2$ (1)
$+ H_2O$
ΔH_1°
Minore stabilizzazione per risonanza dello ione anilinio.
$NH_3^+ + OH^-$
ΔH_2°
$:NH_2$ (2)
$+ H_2O$
$\Delta H_2^\circ > \Delta H_1^\circ$
Maggiore stabilizzazione per risonanza dell'anilina.

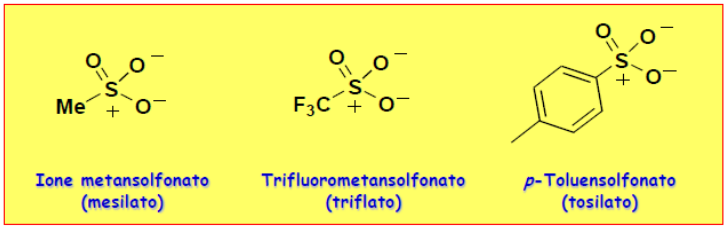

sp3
pKb 2.8
2.89
3.02
sp2
Piridina
Pirimidina
Pirrolo
pKb 8.77
11.3
13.6
9.5
pK6 = 4.76



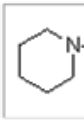
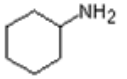
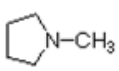
Come fare di un OH^- un buon gruppo uscente?

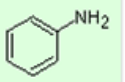
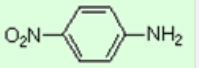
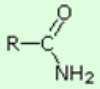
Lo si trasforma nel corrispondente

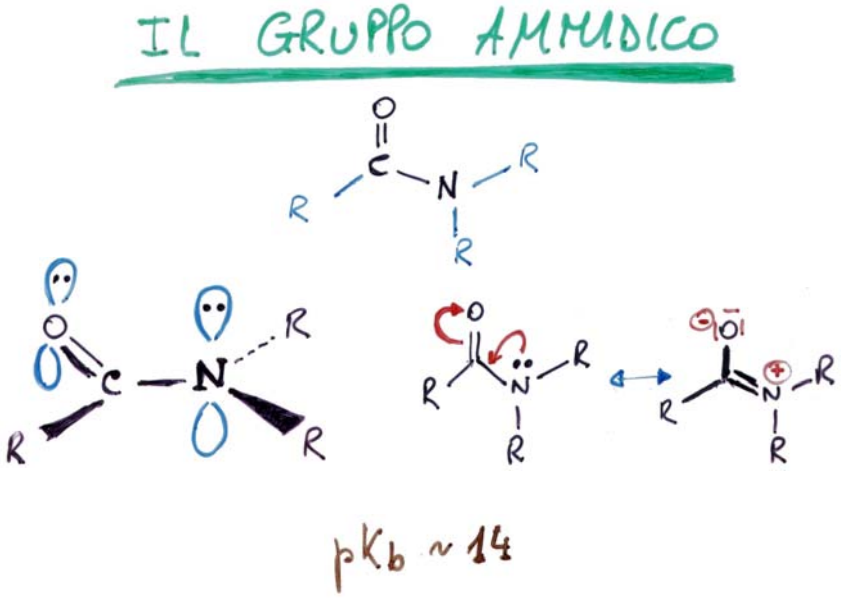
ESTERE SOLFONICO



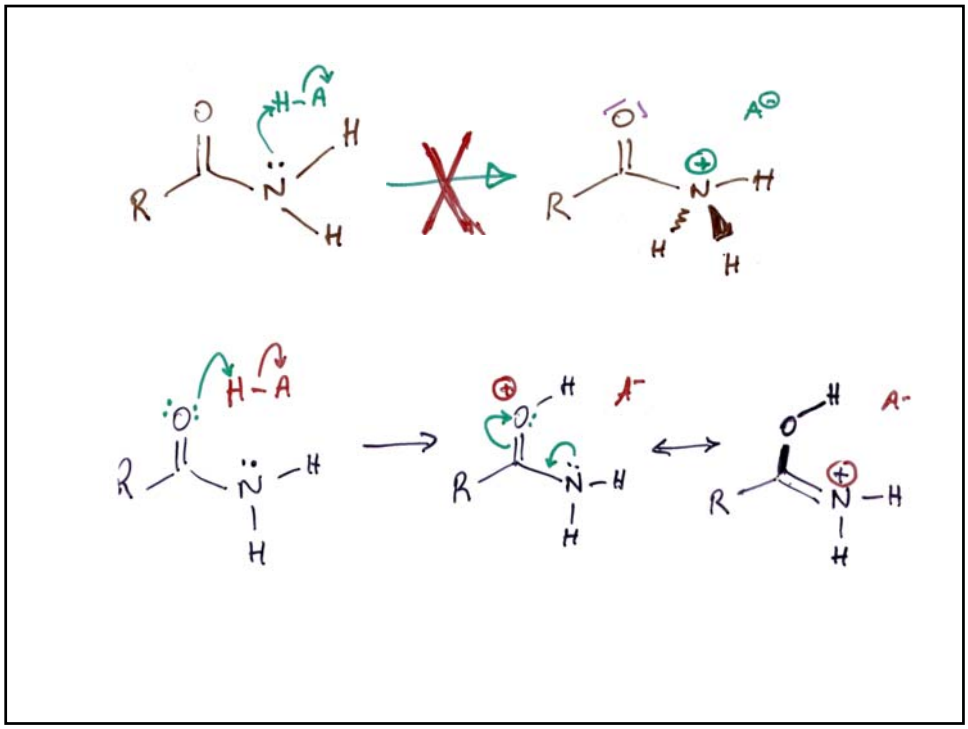
Miglior gruppo uscente: $I^- > RSO_3^- > Br^- > Cl^- >> RCOO^-$

Compound				NH_3
pK_b	3	3.3	3.3	**4.7**

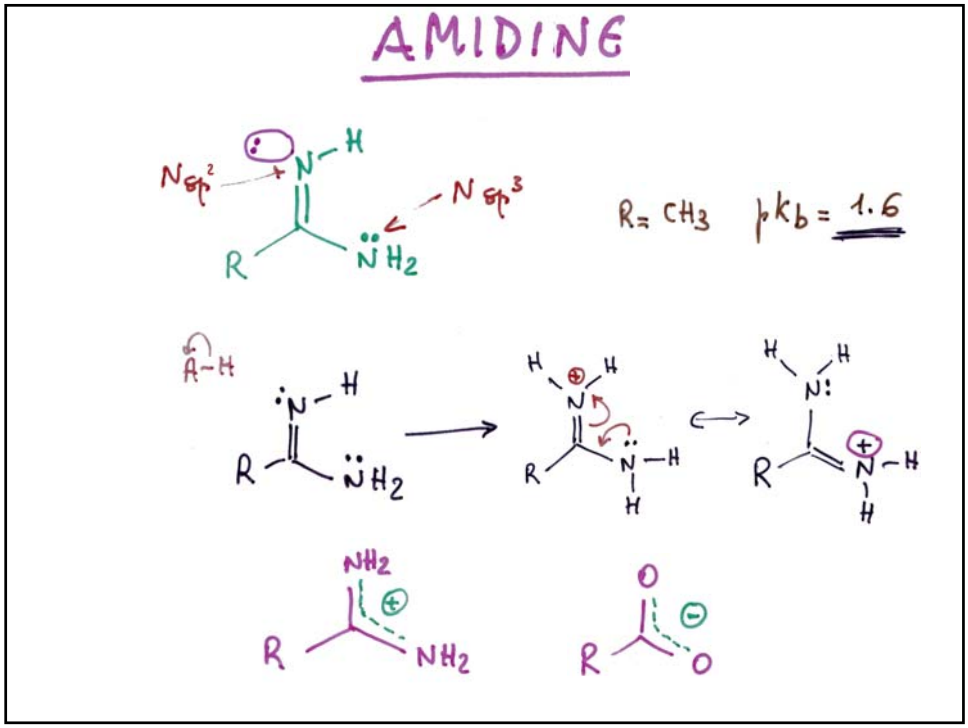
Compound						$CH_3C{\equiv}N$
pK_b	8.8	9.4	13	14	15	24



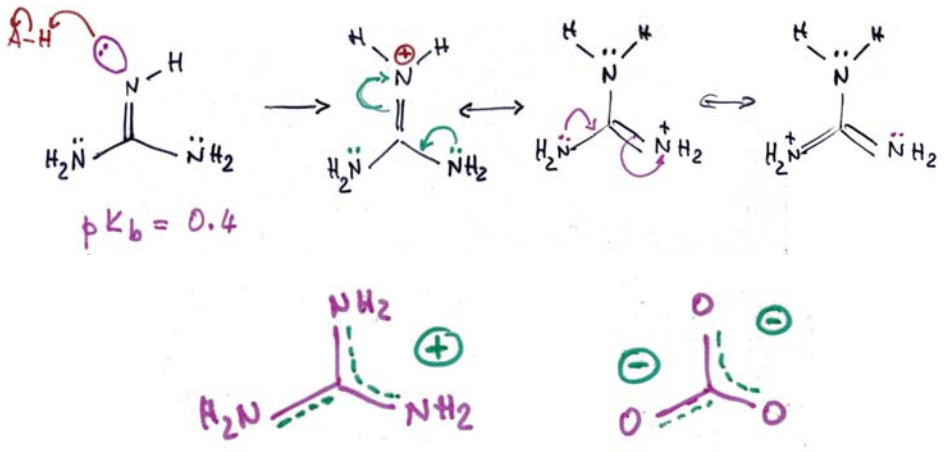
Le **ammidi** sono basi debolissime e manifestano un comportamento debolmente acido

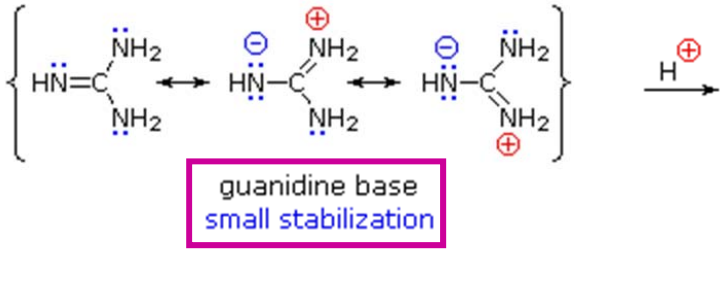


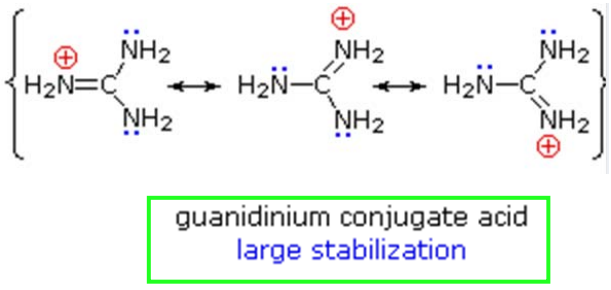
AMIDINE



GUANIDINE


pKb = 0.4


guanidine base
small stabilization


guanidinium conjugate acid
large stabilization

Numero di ossidazione

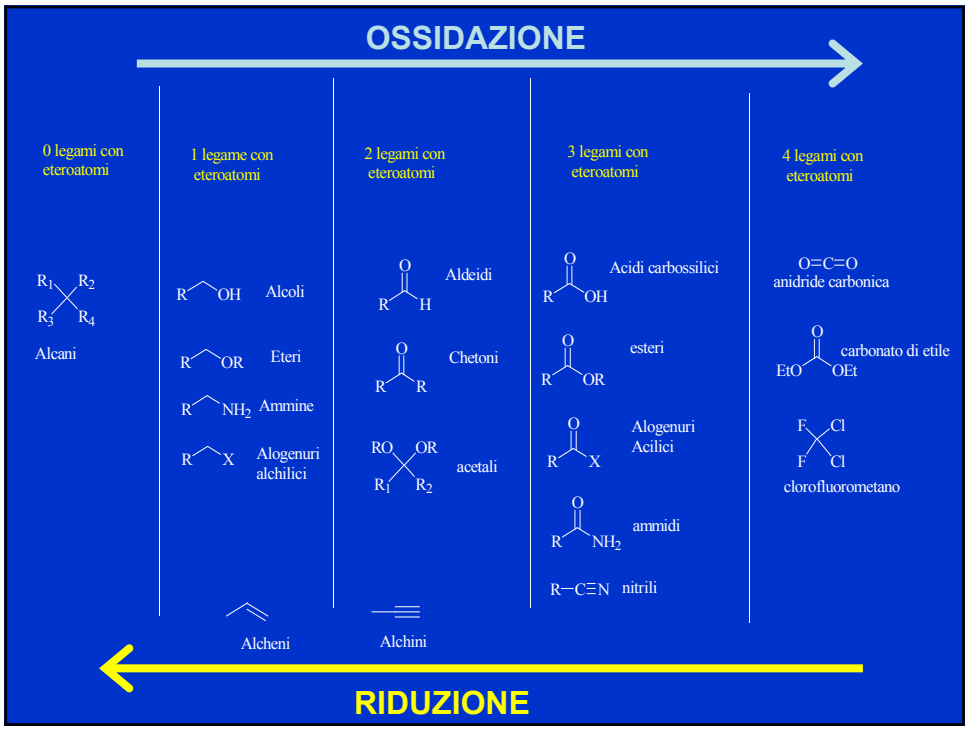
Per numero di ossidazione si intende

IL NUMERO DI ELETTRONI CEDUTI O ACQUISTATI IN MANIERA TOTALE O PARZIALE DA UN ATOMO PER LA FORMAZIONE DI UN LEGAME CHIMICO

o, in altre parole, gli elettroni di valenza di un atomo impegnati in un legame chimico.

LA CARICA CHE L'ATOMO ASSUMEREBBE SE GLI ELETTRONI DI LEGAME FOSSERO ASSEGNATI ALL'ELEMENTO PIÙ ELETTRONEGATIVO

Determinazione del numero di ossidazione


OSSIDAZIONE
0 legami con eteroatomi
1 legame con eteroatomi
2 legami con eteroatomi
3 legami con eteroatomi
4 legami con eteroatomi
Alcani
Alcoli
Eteri
Ammine
Alogenuri alchilici
Alcheni
Aldeidi
Chetoni
acetali
Alchini
Acidi carbossilici
esteri
Alogenuri Acilici
ammidi
nitrili
O=C=O
anidride carbonica
carbonato di etile
clorofluorometano
RIDUZIONE