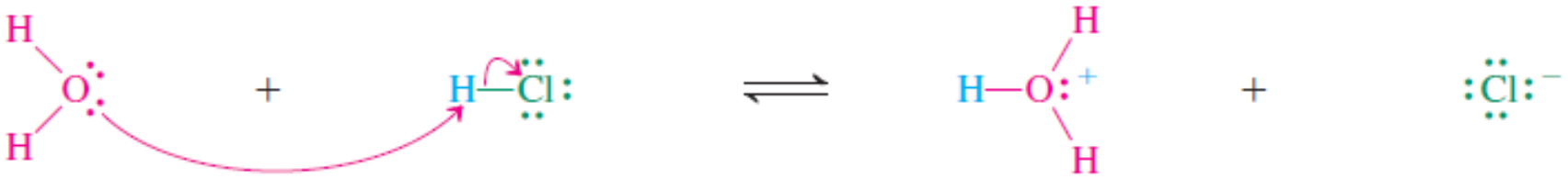
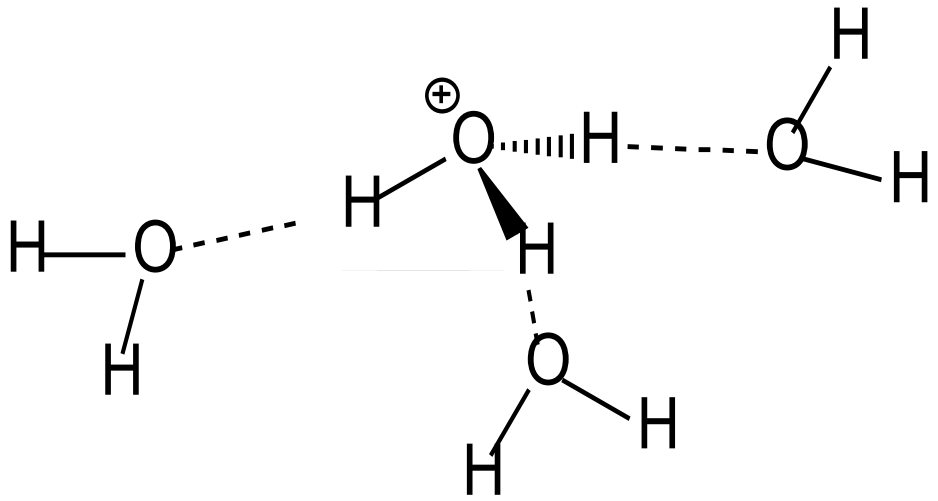
$$HCl(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + Cl^-(aq)$$





$$AH + B \rightleftharpoons BH^+ + A^-$$

$$HA + H_2O \overset{K}{\rightleftharpoons} H_3O^+ + A^- \qquad K = \frac{[H_3O^+][A^-]}{[HA][H_2O]}$$

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

$pK_a = -\log K_a$

- pK_a kyseliny závisí na stabilitě její konjugované báze
- čím silnější HA, tím slabší A^-
- čím silnější A^- , tím slabší AH

silná kyselina

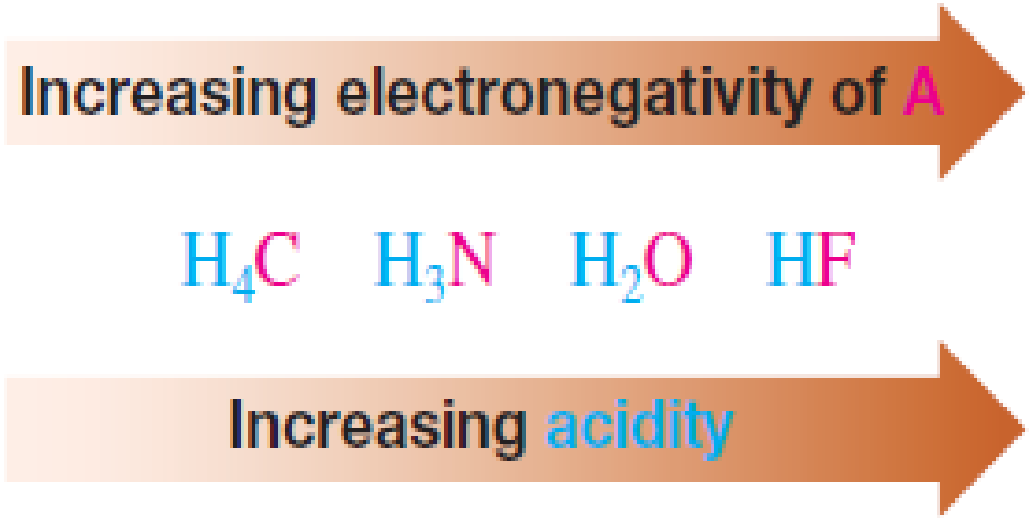
konjugovaná báze je slabá

slabá kyselina

konjugovaná báze silná

JAK ZJISTIT RELATIVNÍ KYSELOST NEBO BAZICITU ZE STRUKTURY LÁTKY

1. Který atom nese náboj?



Hydrid	H-CH_3	H-NH_2	H-OH	H-F
pK_a	55	35	15.7	3.2

čím elektronegativnější prvek záporný náboj nese, tím je konjugovaná báze stabilnější

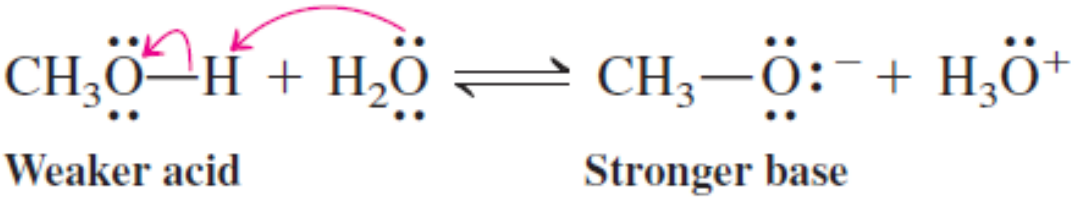
Increasing size of A

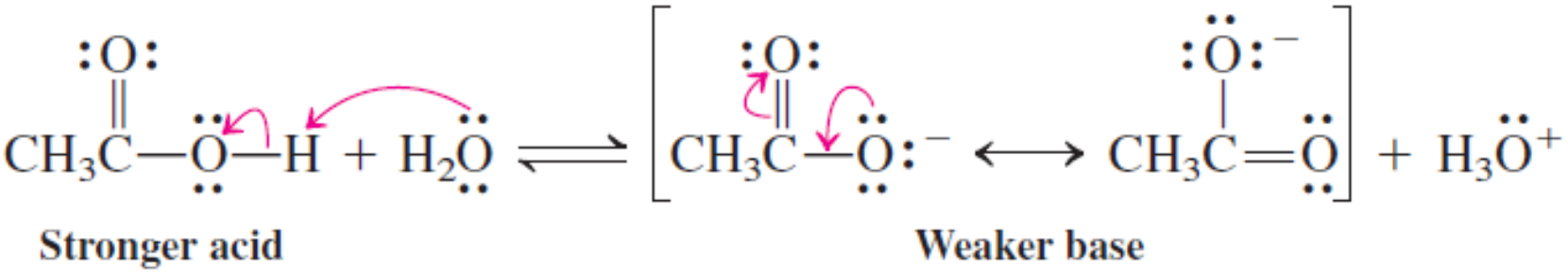
HF HCl HBr HI

Increasing acidity

HX	pK_a	HX	pK_a
HF	3.2	ROH	15-16
HCl	–7	RSH	10
HBr	–9	RSeH	-
HI	–9.5	RTeH	7

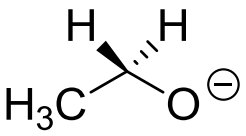
2. Delokalizace náboje v A^- - stabilizace

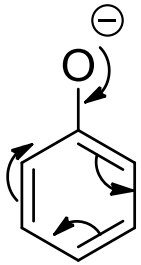


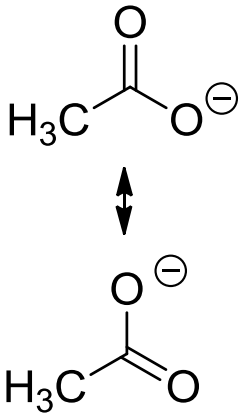


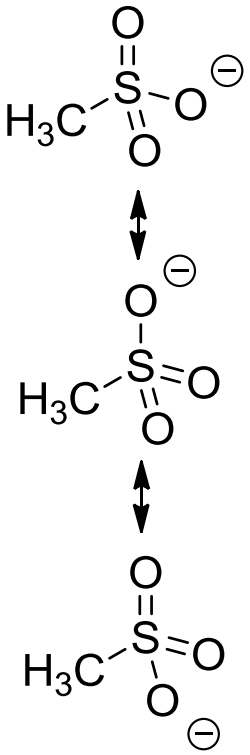
» delokalizace

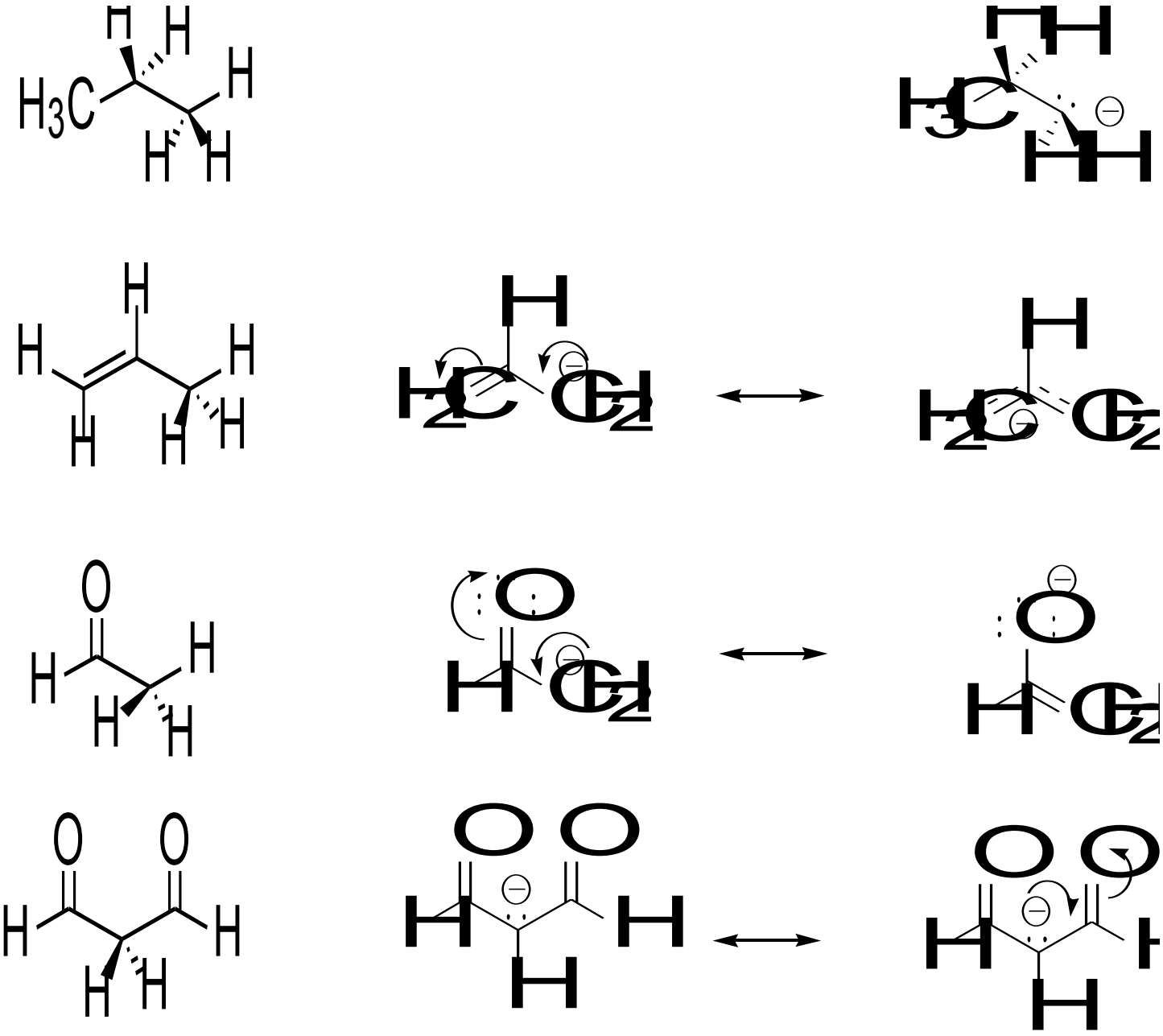
	EtOH	PhOH	CH_3COOH	CH_3SO_3H
pK_a	16	10	4,8	- 1,7



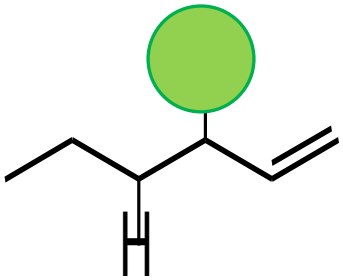


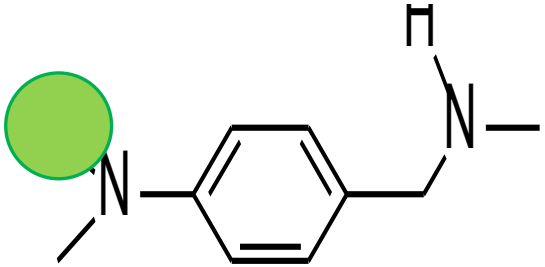


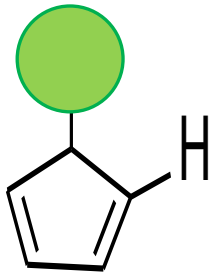


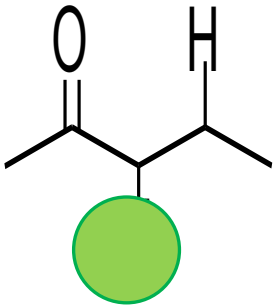


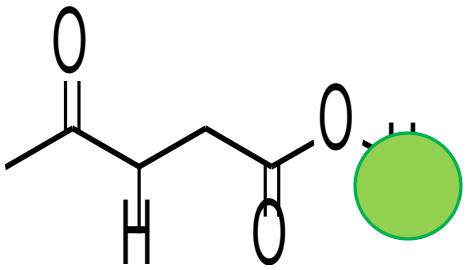
Který z vodíkových atomů v uvedené dvojici je kyselejší

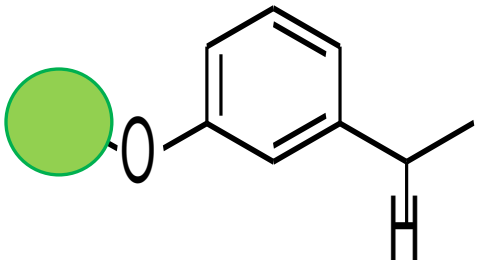




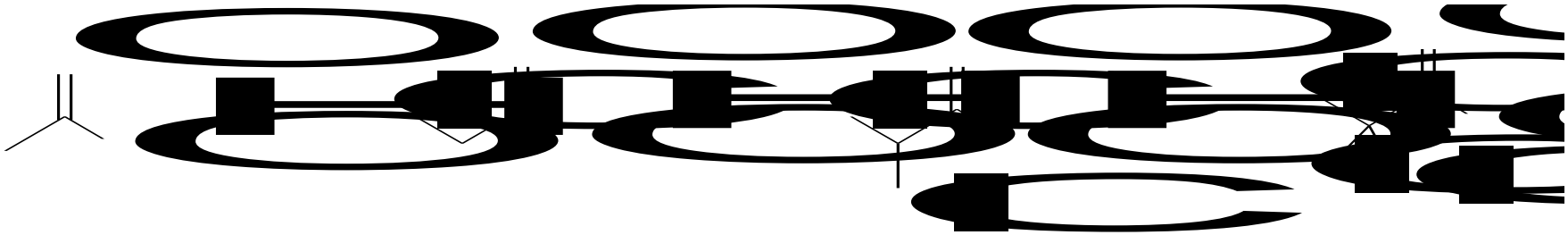






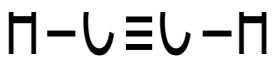
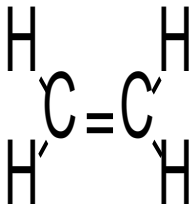
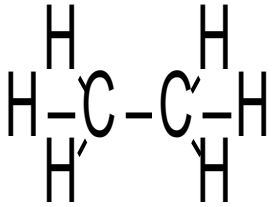


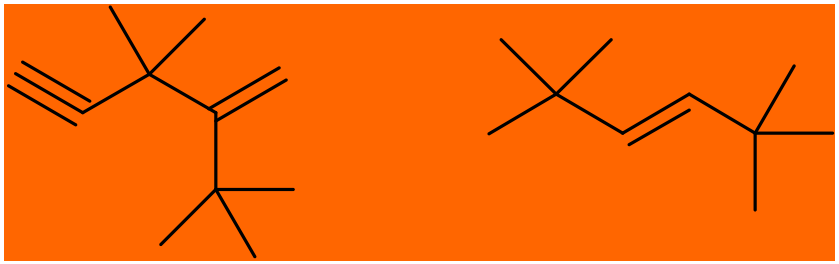
3. Vliv indukčního efektu



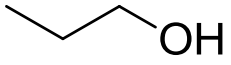
4,75 2,87 1,25 0,70

4. Vliv hybridizace

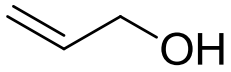
	p*Ka*
	25
	44
	50



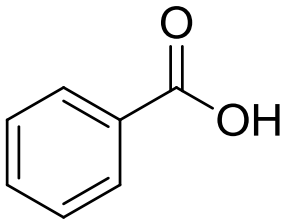
16,1



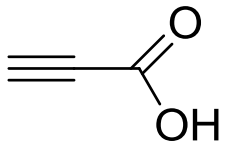
15,5

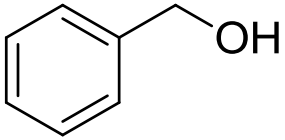


4,2

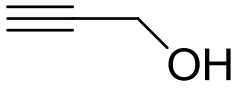


1,9

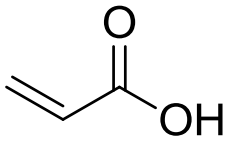




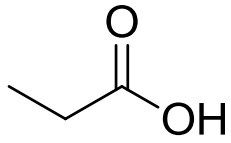
15,4



13,5

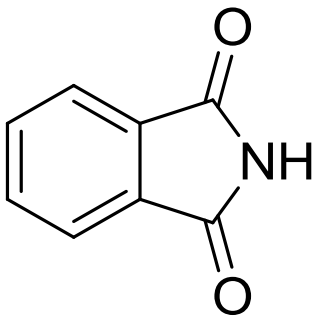


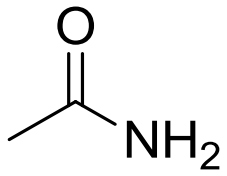
4,2



4,9

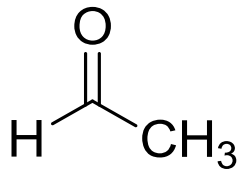
Která ze sloučenin je silnější kyselinou



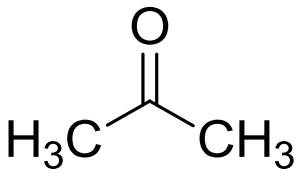


pK_A	8,3	17

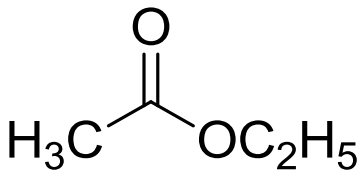
Která ze sloučenin je silnější kyselinou



pK_A 13,5



20



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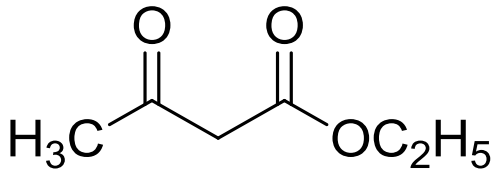
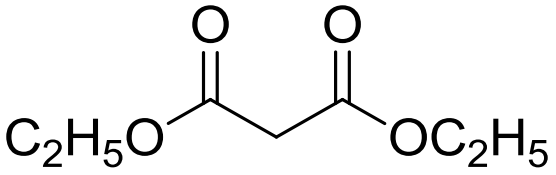


10,6



12,9

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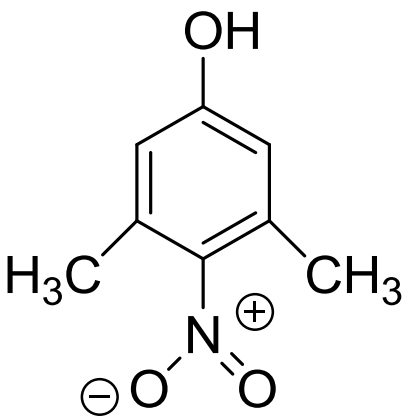
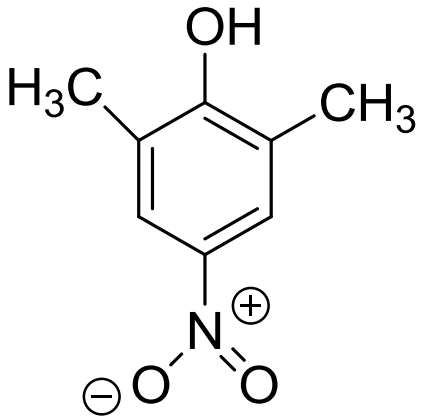


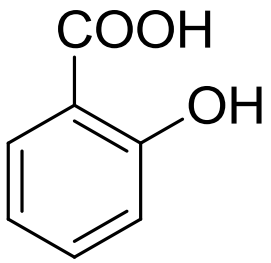


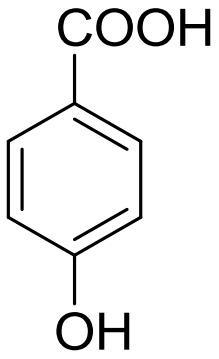
KYSELOST

<

vychýlení z roviny, není dobrá konjugace,
mezomerní efekt zeslaben

Intramolekulární vodíková vazba

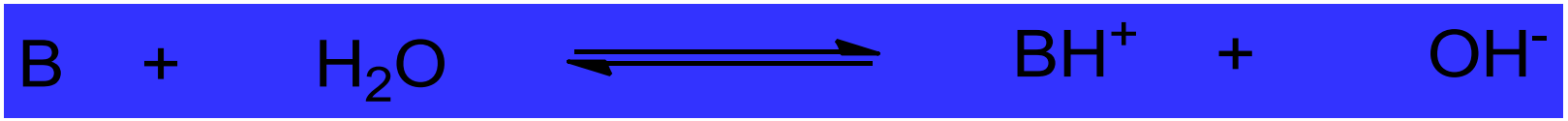




2,98

4,58

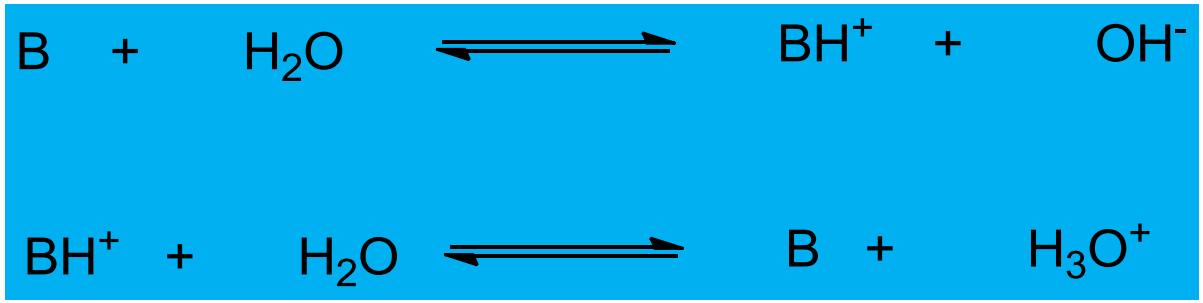
BAZICITA



$$K = \frac{[BH^+]\cdot[OH^-]}{[B]\cdot[H_2O]}$$

$$K \cdot [H_2O] = \frac{[BH^+]\cdot[OH^-]}{[B]} = K_B$$

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

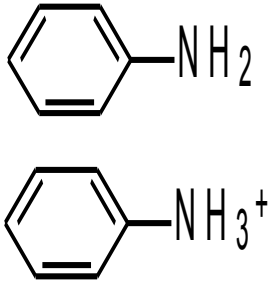


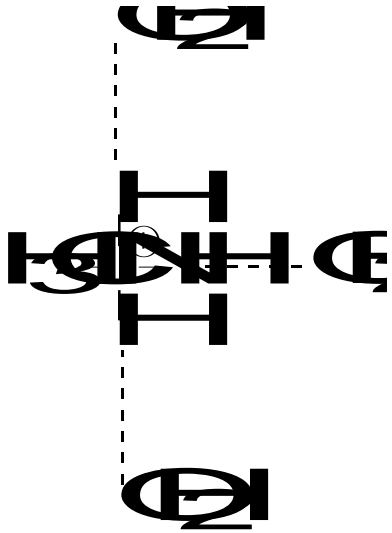
$pK_{AH} + pK_B = 14$

$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$ $\quad pK_B \quad 4{,}75$

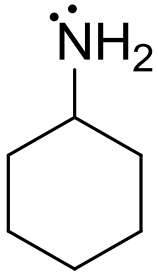
$NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$ $\quad pK_{AH} \quad 9{,}25$

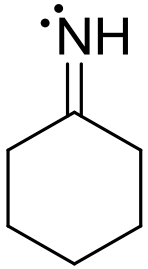
$NH_3 + H_2O \rightleftharpoons NH_2^- + H_3O^+$ $\quad pK_A \quad 35$

	NH_3	CH_3NH_2	$(CH_3)_2NH$	$(CH_3)_3N$	
pK_{AH}	NH_4^+	$CH_3NH_3^+$	$(CH_3)_2NH_2^+$	$(CH_3)_3NH^+$	
					4,58

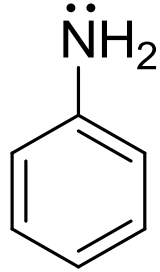


Která ze sloučenin je nejsilnější bazí

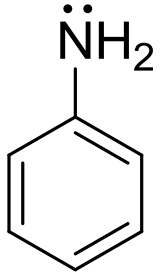


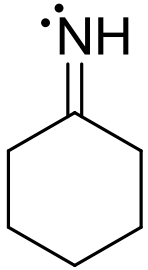


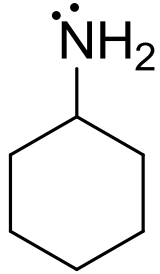
$H_3C-C\equiv N:$



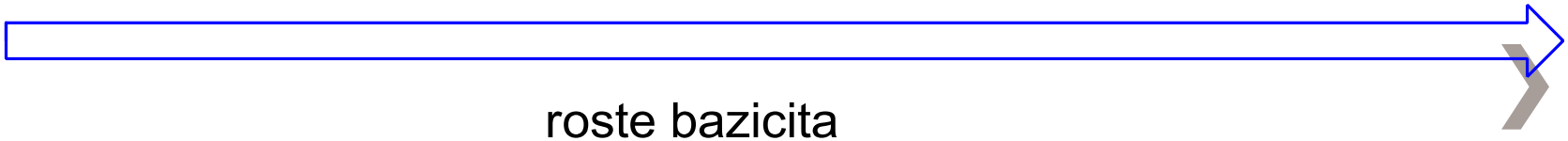
$H_3C-C\equiv N:$





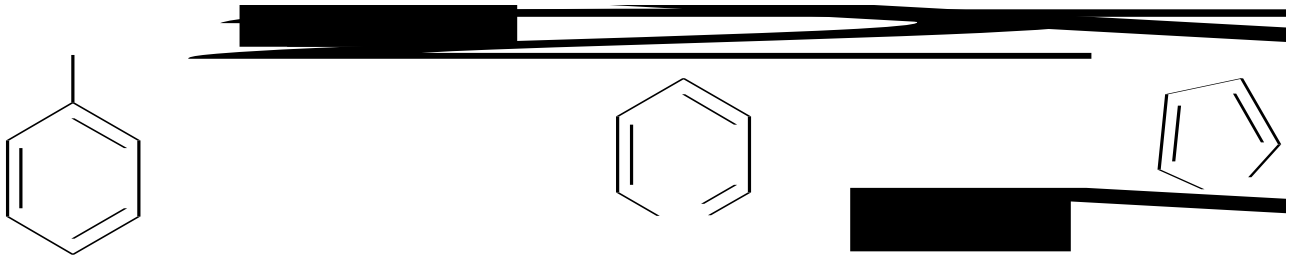


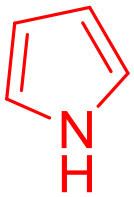
p*Ka* - 10 4,6 9,2 10,7

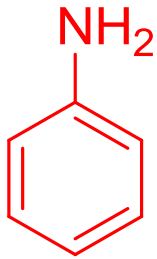


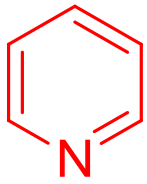
roste bazicita

Uvedené sloučeniny seřaďte podle vzrůstající bazicity



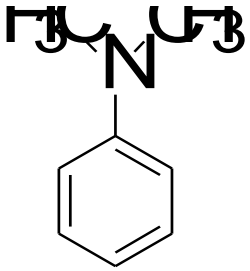


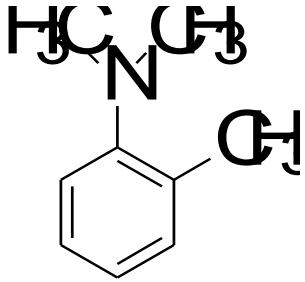




pK_{AH}	-3,8	4,63	5,25

Která ze sloučenin je silnější bazí

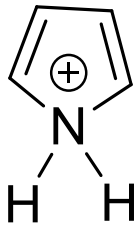


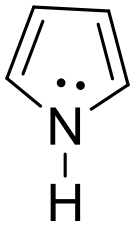


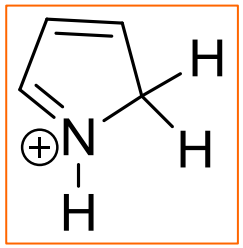
Která ze sloučenin je bazičtější a proč

pK_{AH}

-3,8

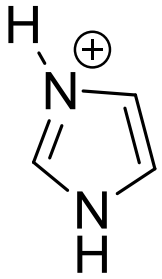


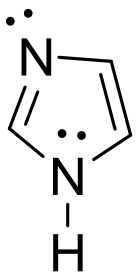


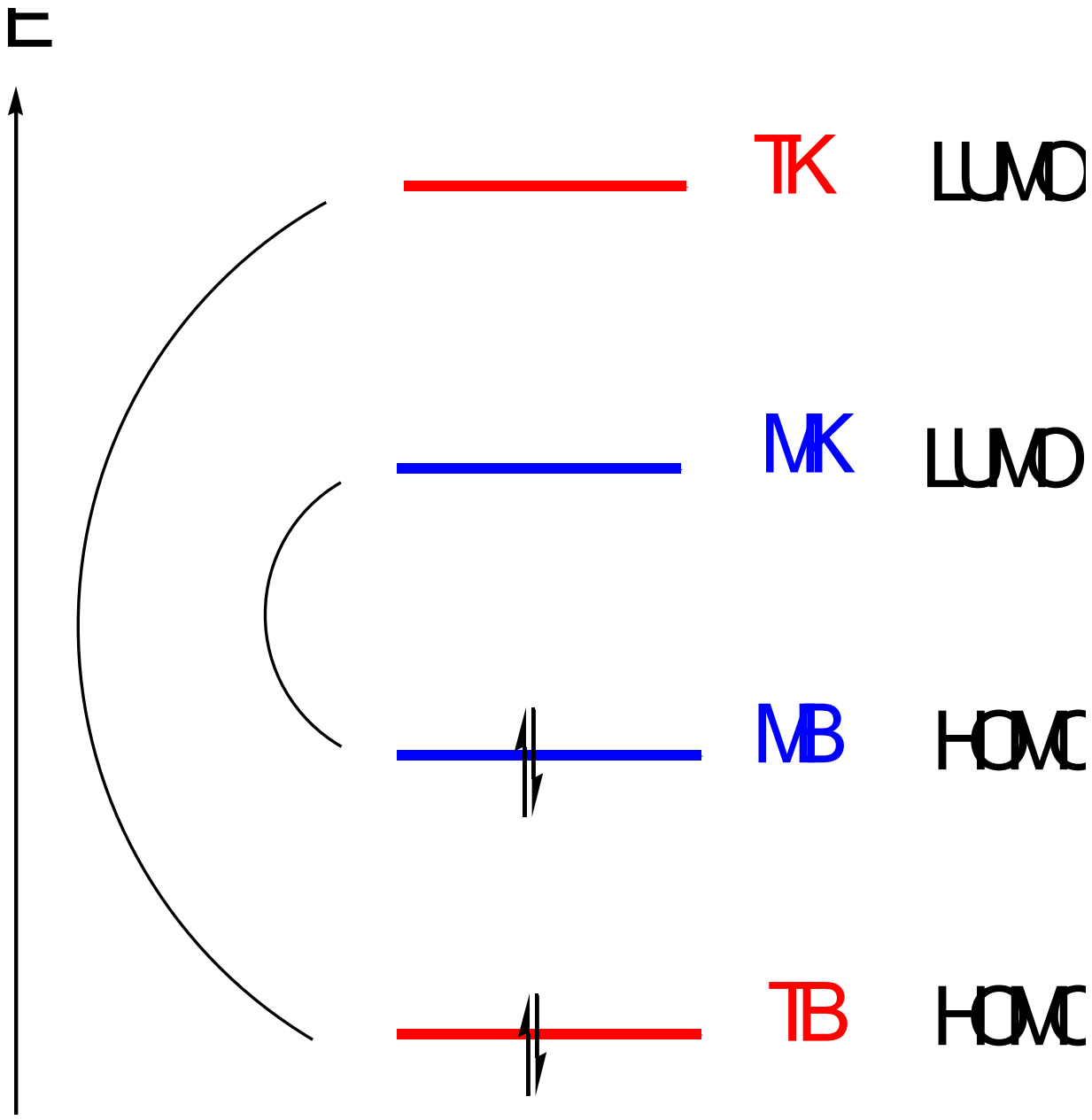


kladný náboj
delokalizovaný

7,1

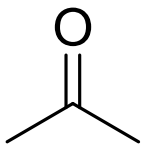




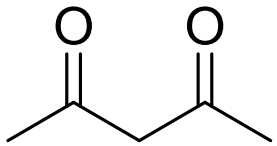

E
TK
LUMO
MK
LUMO
MB
HOMO
TB
HOMO

Která z látek může svůj nejkyselejší vodíkový atom odštěpit působením $NaHCO_3$

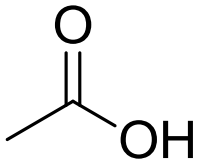
pK_A

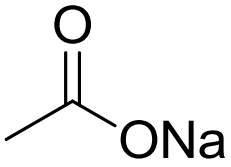


19,3

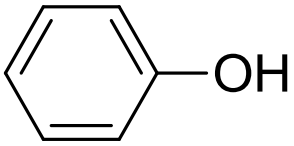


9



4,76 + $NaHCO_3$ ⟶  + H_2CO_3

6,37

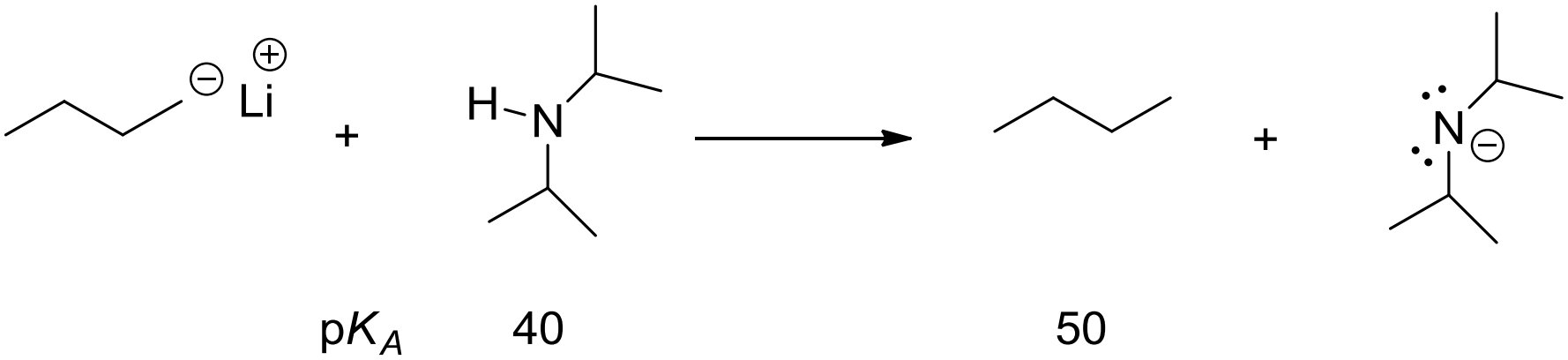


10

Báze silnější než OH^- nemohou být použité ve vodě

$$NH_2^- + H_2O \longrightarrow NH_3 + OH^-$$

pK_A	15,7	35



pK_A	40	50