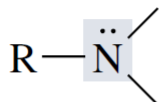
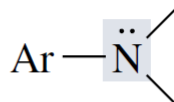




Aminas



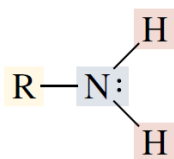
R = alkyl group:
alkylamine



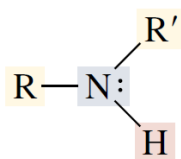
Ar = aryl group:
arylamine



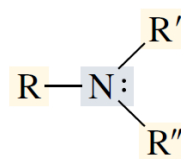
Aminas



Primary amine



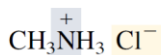
Secondary amine



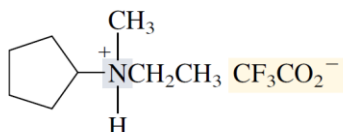
Tertiary amine



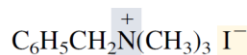
Sais de amônio quaternário



Methylammonium
chloride



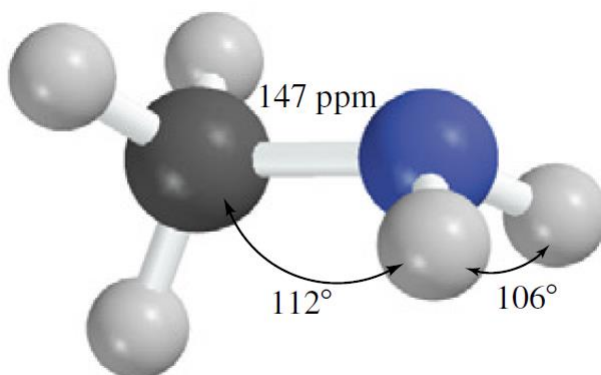
N-Ethyl-*N*-methylcyclopentyl-
ammonium trifluoroacetate



Benzyltrimethyl-
ammonium iodide
(a quaternary ammonium
salt)

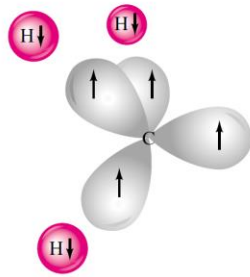


Aminas: estrutura

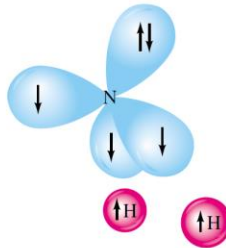




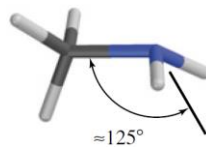
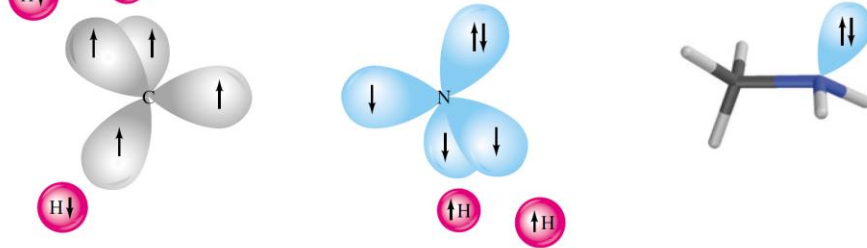
C & N



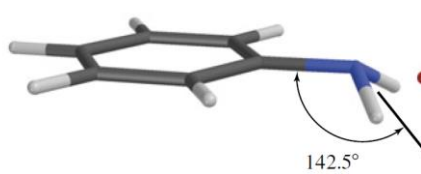
(a)



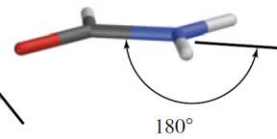
(b)



Methylamine
(CH_3NH_2)



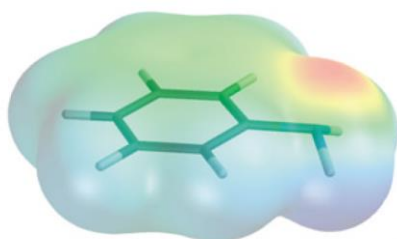
Aniline
($\text{C}_6\text{H}_5\text{NH}_2$)



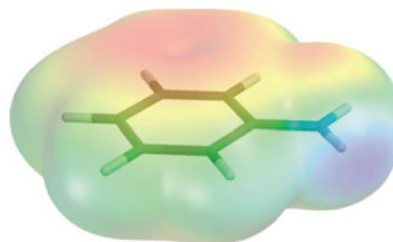
Formamide
($\text{O}=\text{CHNH}_2$)



Mapas de potencial eletrostático, MEP



(a)

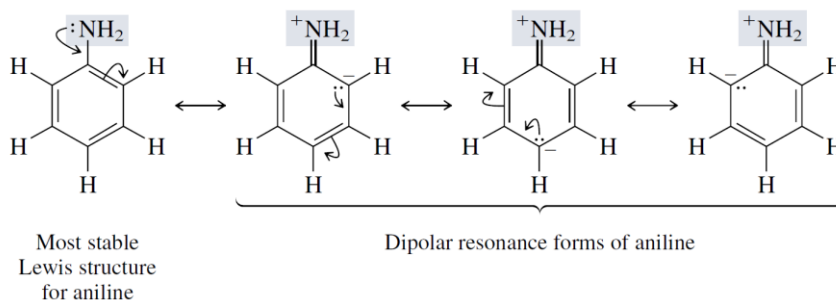


(b)

Qual é o estado de hibridização do N?
Estado de hibridização do N entre sp^3 e sp^2 !

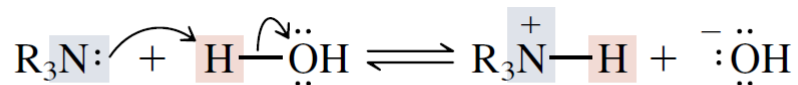


Deslocalização do par de e^- do N





Basicidade das aminas

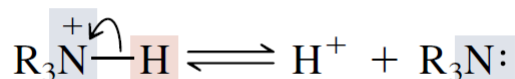


$$K_b = \frac{[\text{R}_3\text{NH}^+][\text{HO}^-]}{[\text{R}_3\text{N}]} \quad \text{and} \quad \text{p}K_b = -\log K_b$$

$$K_b = 1.8 \times 10^{-5} \quad (\text{p}K_b = 4.7)$$

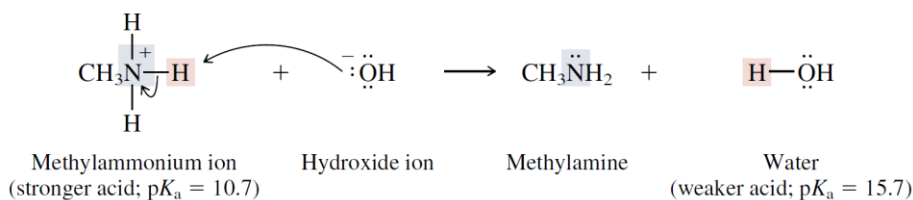
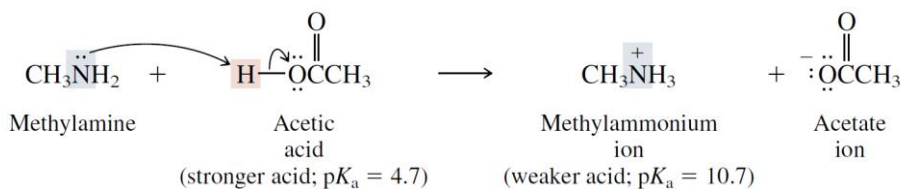


Constante de dissociação



$$K_a = \frac{[\text{H}^+][\text{R}_3\text{N}]}{[\text{R}_3\text{NH}^+]} \quad \text{and} \quad \text{p}K_a = -\log K_a$$

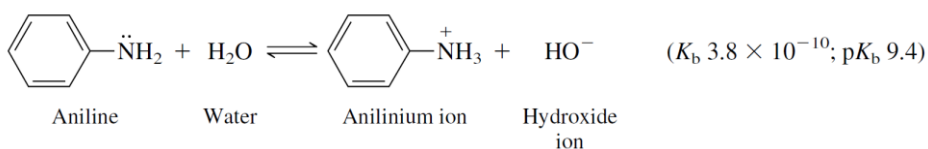
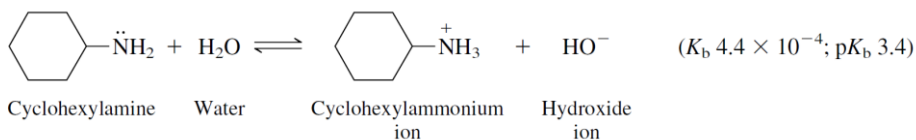
$$K_a = 5.6 \times 10^{-10} \quad (\text{p}K_a = 9.3)$$



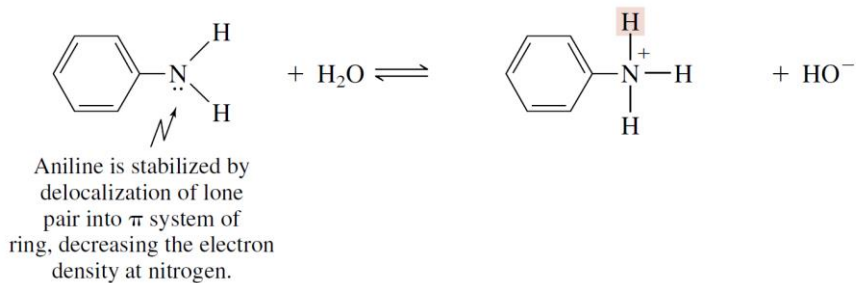
Base Strength of Amines As Measured by Their Basicity Constants and the Dissociation Constants of Their Conjugate Acids*

Compound	Structure	Basicity		Acidity of conjugate acid	
		K_b	pK_b	K_a	pK_a
Ammonia	NH_3	1.8×10^{-5}	4.7	5.5×10^{-10}	9.3
Primary amines					
Methylamine	CH_3NH_2	4.4×10^{-4}	3.4	2.3×10^{-11}	10.6
Ethylamine	$\text{CH}_3\text{CH}_2\text{NH}_2$	5.6×10^{-4}	3.2	1.8×10^{-11}	10.8
Isopropylamine	$(\text{CH}_3)_2\text{CHNH}_2$	4.3×10^{-4}	3.4	2.3×10^{-11}	10.6
tert-Butylamine	$(\text{CH}_3)_3\text{CNH}_2$	2.8×10^{-4}	3.6	3.6×10^{-11}	10.4
Aniline	$\text{C}_6\text{H}_5\text{NH}_2$	3.8×10^{-10}	9.4	2.6×10^{-5}	4.6
Secondary amines					
Dimethylamine	$(\text{CH}_3)_2\text{NH}$	5.1×10^{-4}	3.3	2.0×10^{-11}	10.7
Diethylamine	$(\text{CH}_3\text{CH}_2)_2\text{NH}$	1.3×10^{-3}	2.9	7.7×10^{-12}	11.1
N-Methylaniline	$\text{C}_6\text{H}_5\text{NHCH}_3$	6.1×10^{-10}	9.2	1.6×10^{-5}	4.8
Tertiary amines					
Trimethylamine	$(\text{CH}_3)_3\text{N}$	5.3×10^{-5}	4.3	1.9×10^{-10}	9.7
Triethylamine	$(\text{CH}_3\text{CH}_2)_3\text{N}$	5.6×10^{-4}	3.2	1.8×10^{-11}	10.8
N,N-Dimethylaniline	$\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$	1.2×10^{-9}	8.9	8.3×10^{-6}	5.1

*In water at 25°C.

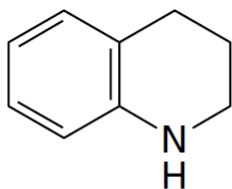


A anilina é uma base
muito mais fraca por causa
da deslocalização do par
de elétrons do N

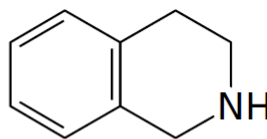




Desafio: diferença no
valor de $K_b = 40.000!$



Tetrahydroquinoline

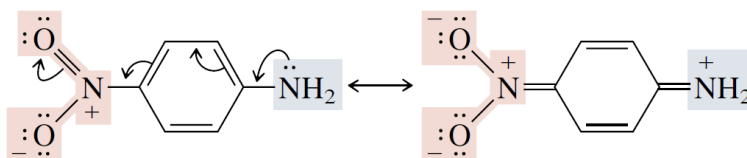


Tetrahydroisoquinoline

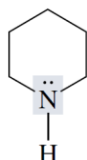


Effect of Substituents on the Basicity of Aniline

	X	K_b	pK_b
	H	4×10^{-10}	9.4
	CH ₃	2×10^{-9}	8.7
	CF ₃	2×10^{-12}	11.5
	O ₂ N	1×10^{-13}	13.0

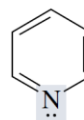


Electron delocalization in *p*-nitroaniline

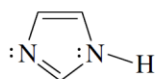


Piperidine
($K_b = 1.6 \times 10^{-3}$; $pK_b = 2.8$)

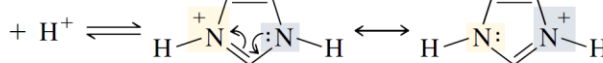
is more basic than



Pyridine
($K_b = 1.4 \times 10^{-9}$; $pK_b = 8.8$)



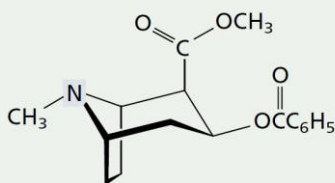
Imidazole
($K_b = 1 \times 10^{-7}$; $pK_b = 7$)



Imidazolium ion

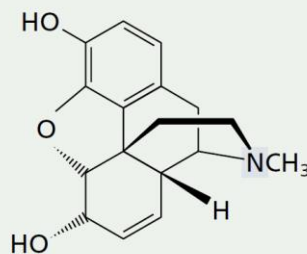


Produtos Naturais



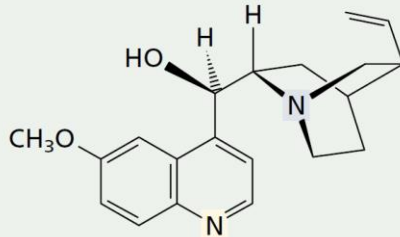
Cocaine

(A central nervous system stimulant obtained from the leaves of the coca plant.)



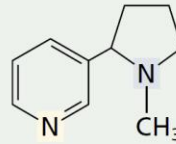
Morphine

(An opium alkaloid. Although it is an excellent analgesic, its use is restricted because of the potential for addiction. Heroin is the diacetate ester of morphine.)



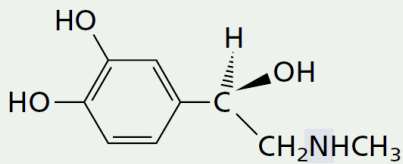
Quinine

(Alkaloid of cinchona bark
used to treat malaria)



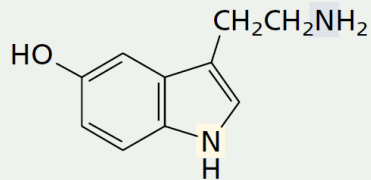
Nicotine

(An alkaloid present in tobacco;
a very toxic compound sometimes
used as an insecticide)



Epinephrine

(Also called *adrenaline*; a
hormone secreted by the
adrenal gland that prepares
the organism for "flight or
fight.")

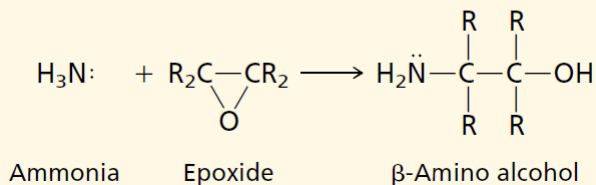
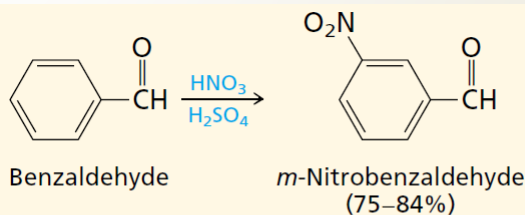
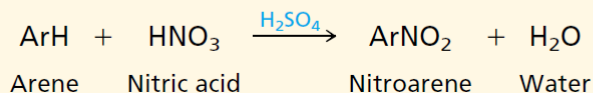
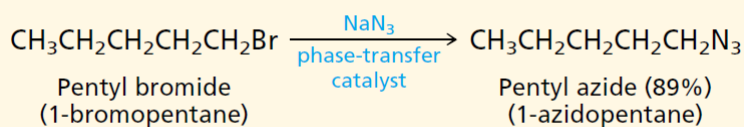
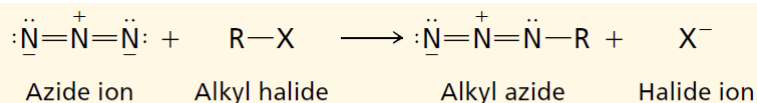
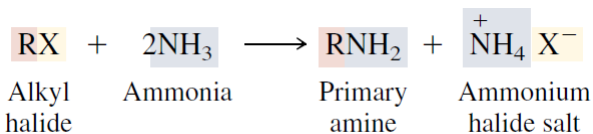


Serotonin

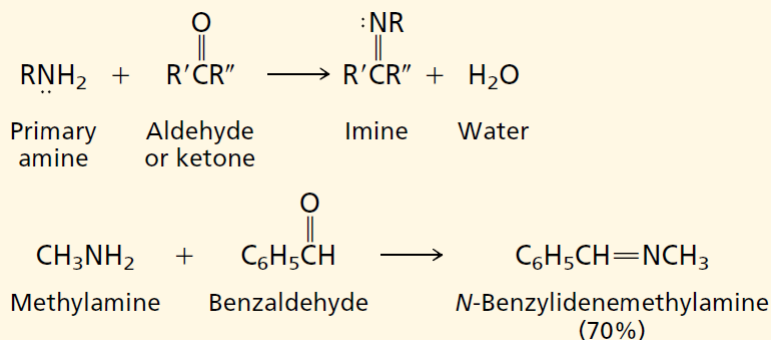
(A hormone synthesized in
the pineal gland. Certain
mental disorders are be-
lieved to be related to sero-
tonin levels in the brain.)



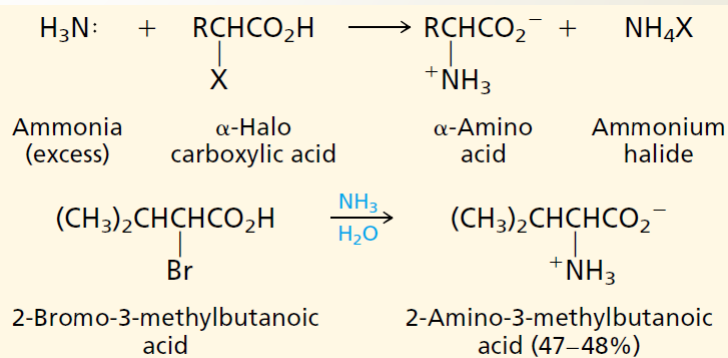
Preparação de aminas



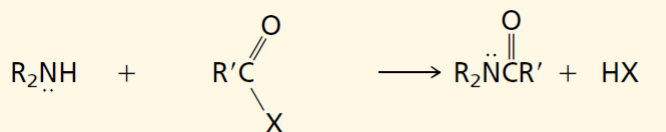
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for better
health!



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science
for better
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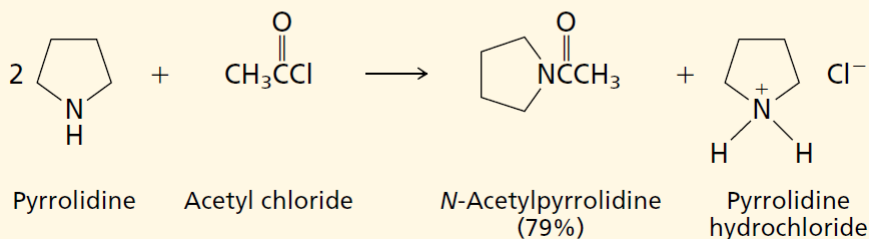
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Primary or
secondary
amine, or
ammonia

Acyl chloride, acid
anhydride, or ester

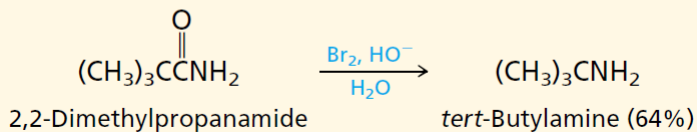
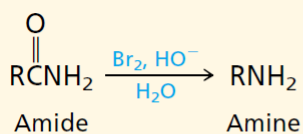
Amide Water

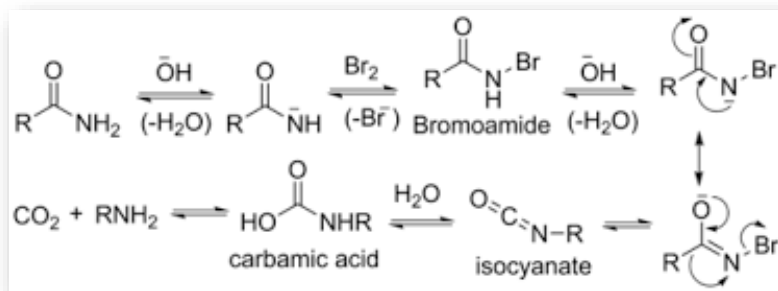


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O rearranjo de Hofmann

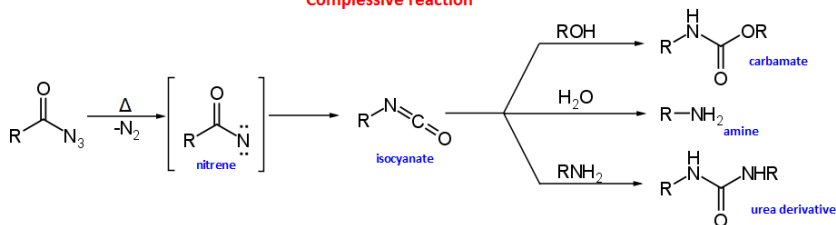


$$\begin{array}{ccccccc} \text{O} & & & & & & \\ \parallel & & & & & & \\ \text{RCNH}_2 & + & \text{Br}_2 & + & 4\text{HO}^- & \longrightarrow & \text{RNH}_2 + 2\text{Br}^- + \text{CO}_3^{2-} + 2\text{H}_2\text{O} \\ \text{Amide} & & \text{Bromine} & & \text{Hydroxide} & & \text{Amine} & \text{Bromide} & & \text{Carbonate} & & \text{Water} \\ & & & & \text{ion} & & & \text{ion} & & \text{ion} & & \end{array}$$


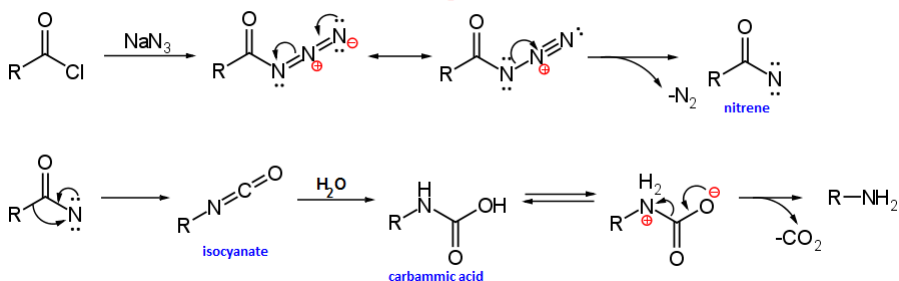


O rearranjo de Curtius

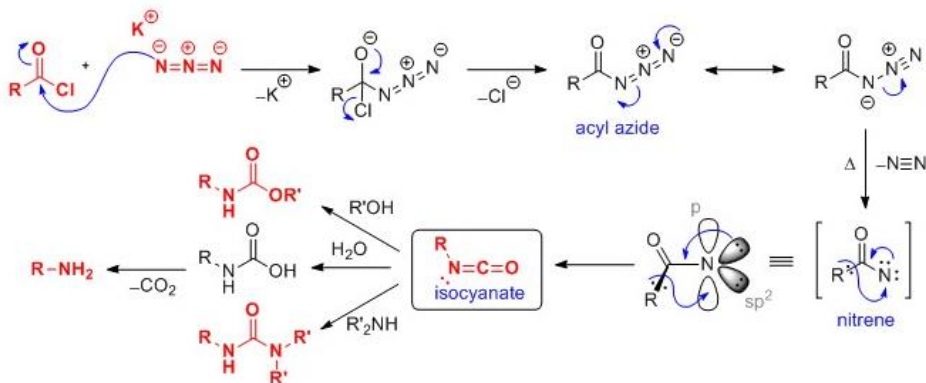
Comprehensive reaction



Curtius rearrangement



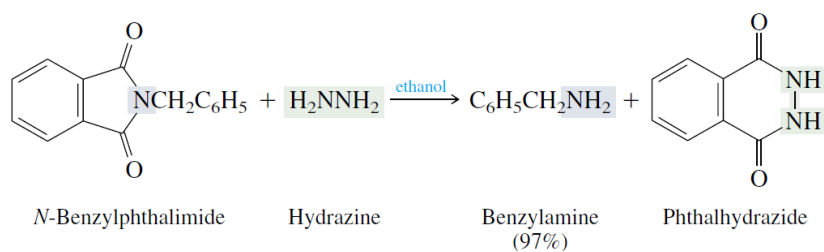
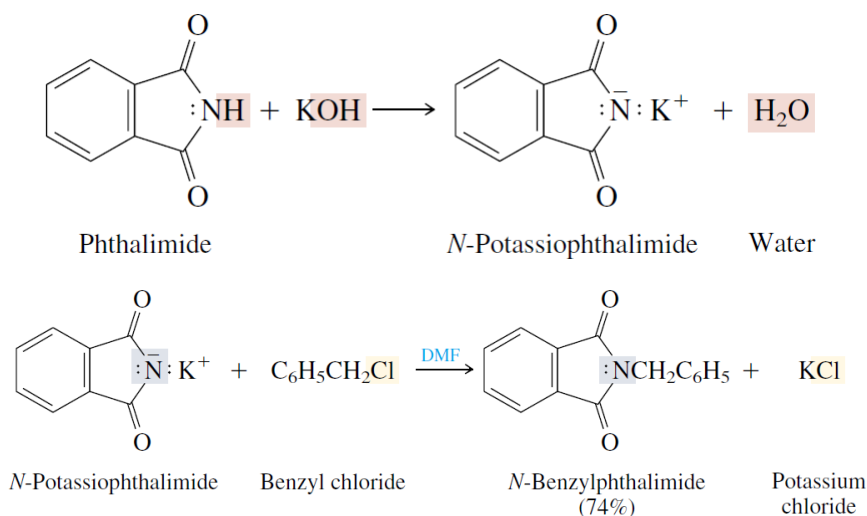
Mais sobre o rearranjo...



Depois de Valiulin

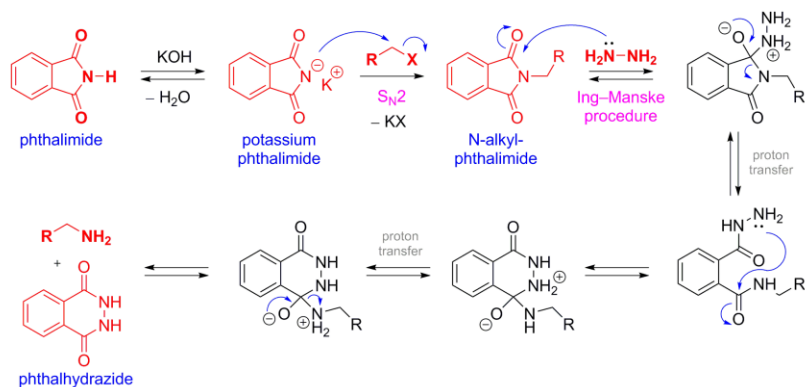


Síntese de Gabriel para Alquilaminas primárias





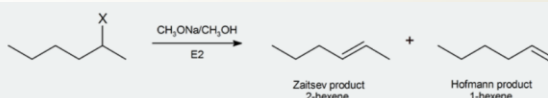
Mecanismo



Depois de Valiulin



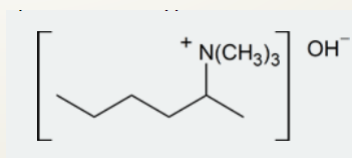
Eliminação E2 de Hofmann



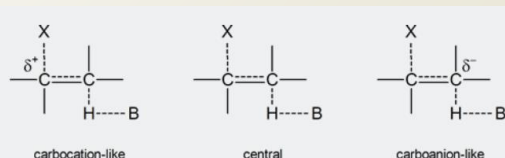
The table below describes the proportion of each product you would expect when X in the above reaction represents a given halogen.

X	% 2-hexene	% hexene
I	81	19
Br	72	28
Cl	67	33
F	30	70

EWG (pointing down from I to F) and **% Hofmann** (pointing up from F to I)

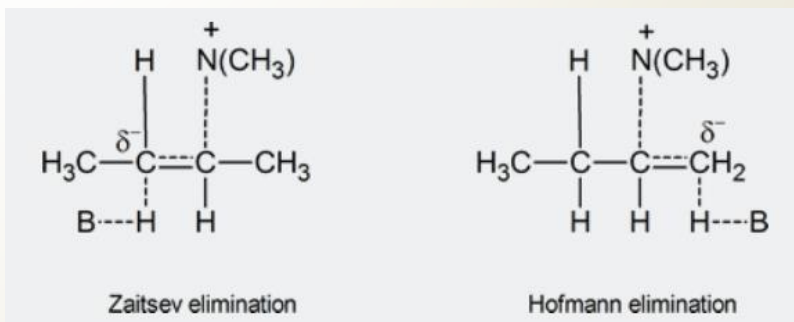
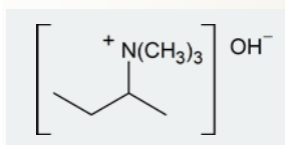


<https://chem.libretexts.org/>



Various transition states for an E2 elimination reaction

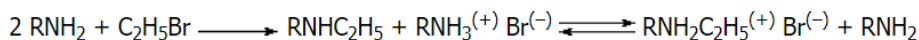
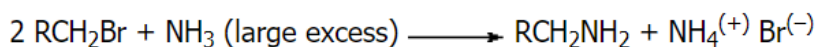
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health!



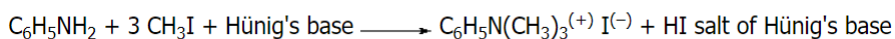
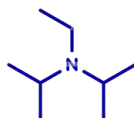
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science
for better
health!



Alquilação de Aminas

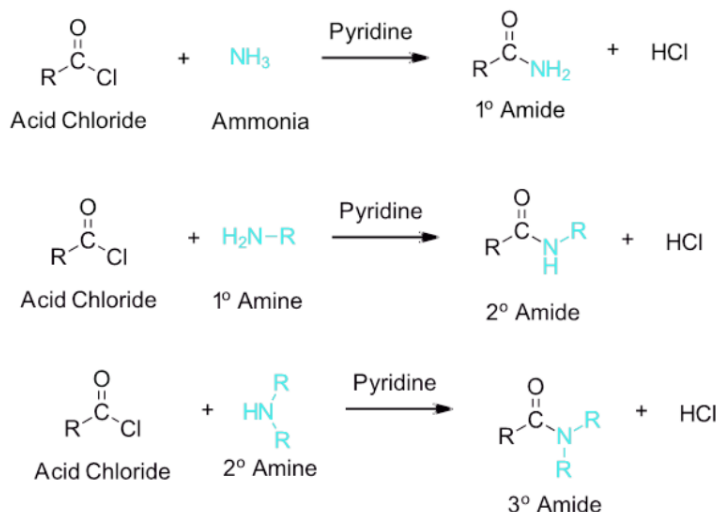


Infelizmente, a alquilação direta de aminas 1^{as} ou 2^{as} para produzir um produto mais substituído não ocorre de forma limpa.



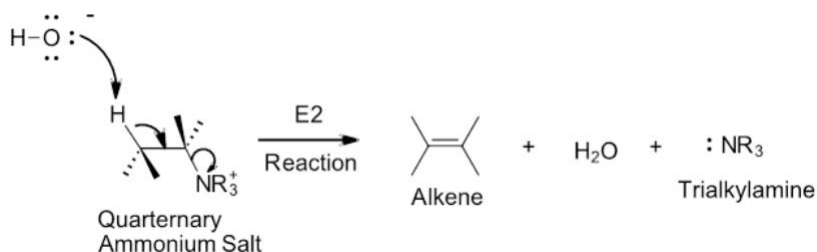
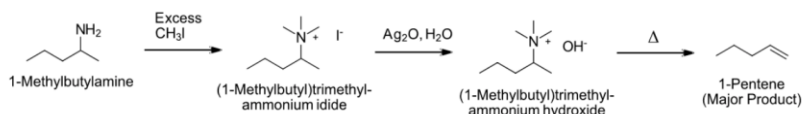


Acilação de Aminas



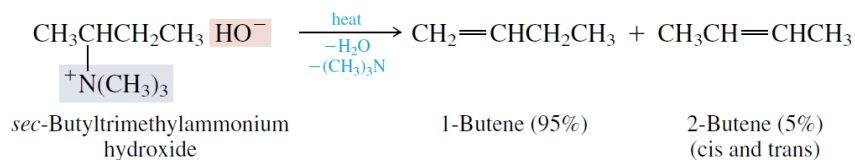
De volta para a Eliminação de Hofmann

General Reaction

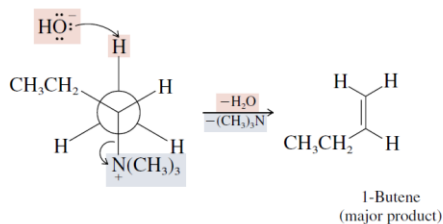




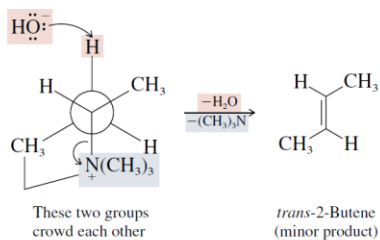
A regra de Hofmann



(a) *Less crowded*: Conformation leading to 1-butene by anti elimination:



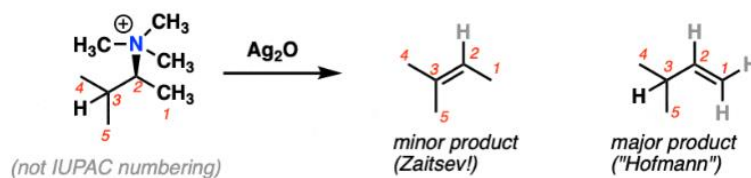
(b) *More crowded*: Conformation leading to *trans*-2-butene by anti elimination:





Why isn't the Zaitsev the major product?

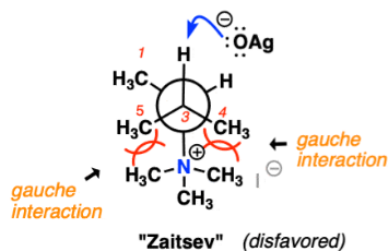
Because of the bulky leaving group!!!



Zaitsev & Hofmann

Newman projection of conformation
giving "Zaitsev" product:

looking along C_2-C_3 bond
(C_3 in front, C_2 behind)



higher energy transition state
due to steric clash with leaving group

Newman projection of conformation
giving "Hofmann" product:

looking along C_1-C_2 bond
(C_1 in front, C_2 behind)

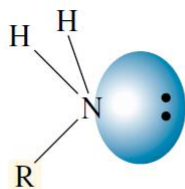


lower energy transition state
fewer steric interactions

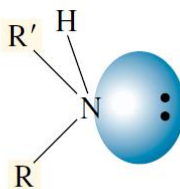
<https://www.masterorganicchemistry.com/>



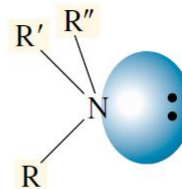
Sumário



Primary amine



Secondary amine

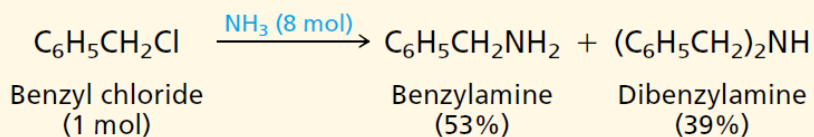
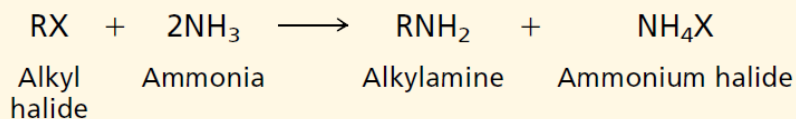


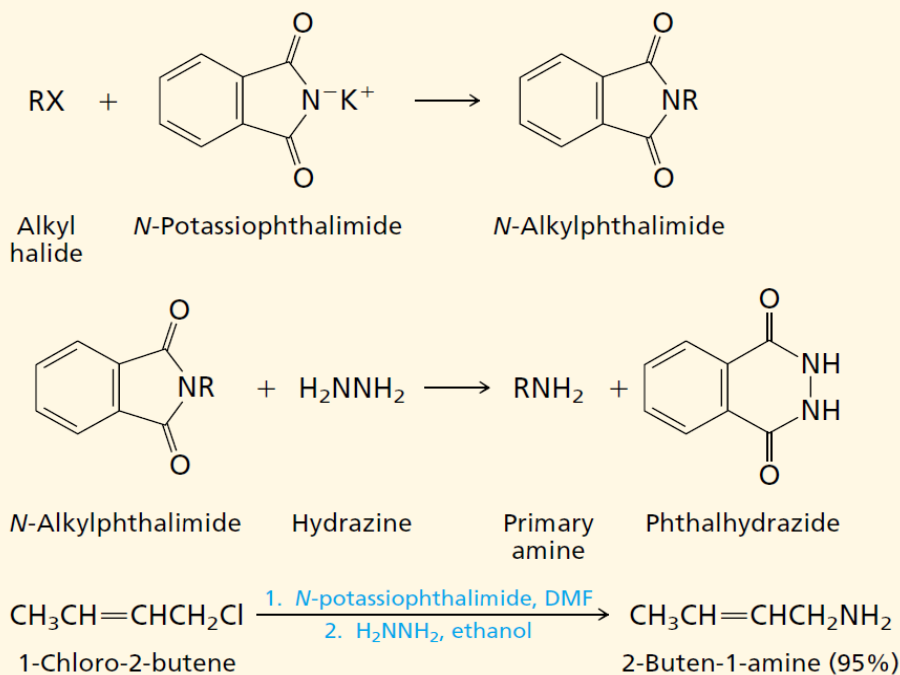
Tertiary amine



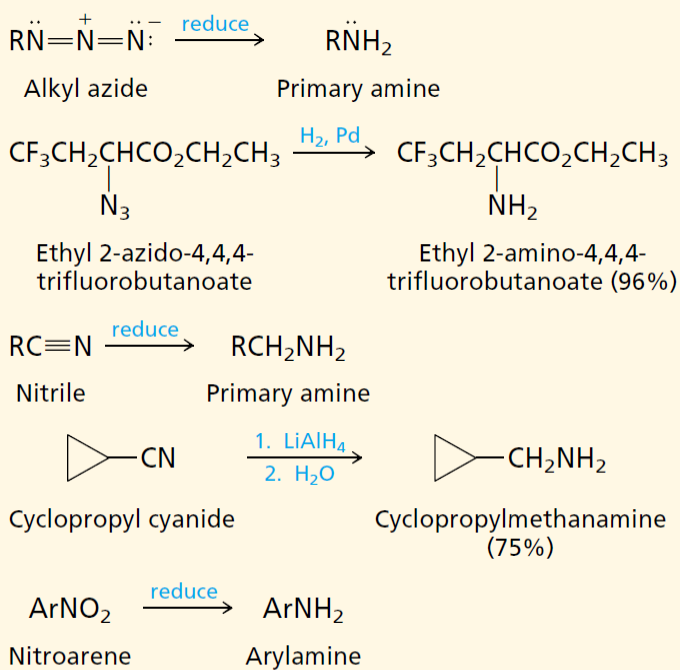
Sumário

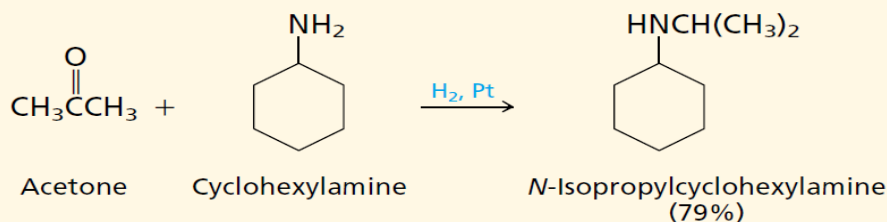
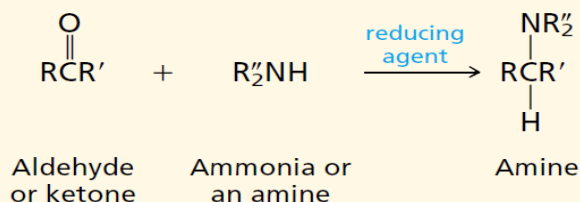
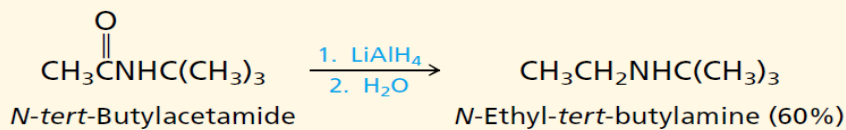
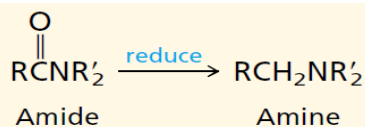
General equation and specific example



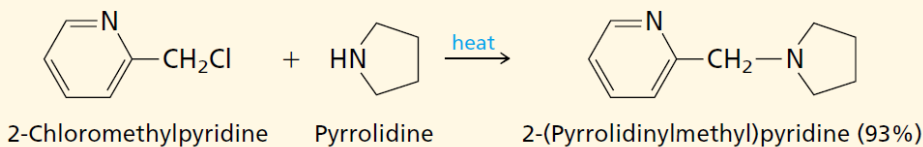
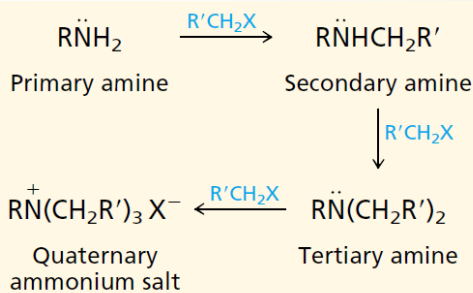


Métodos de redução



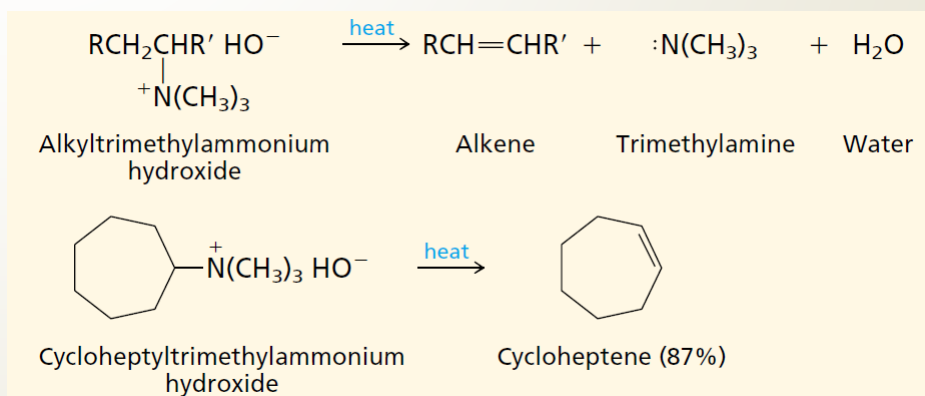


Alquilação

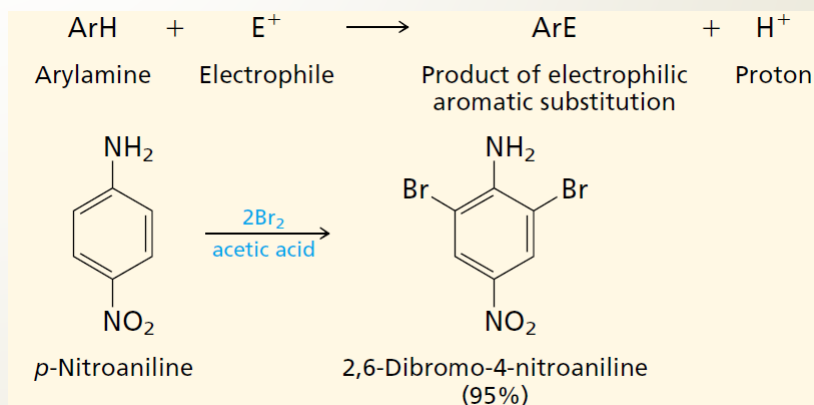




Eliminação de Hofmann



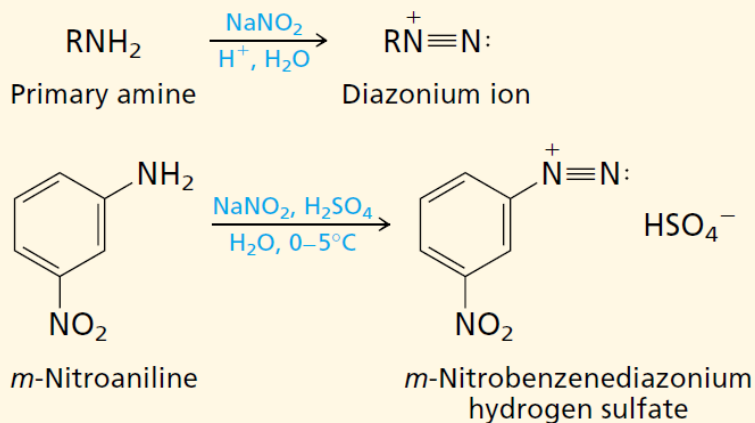
S_EAr



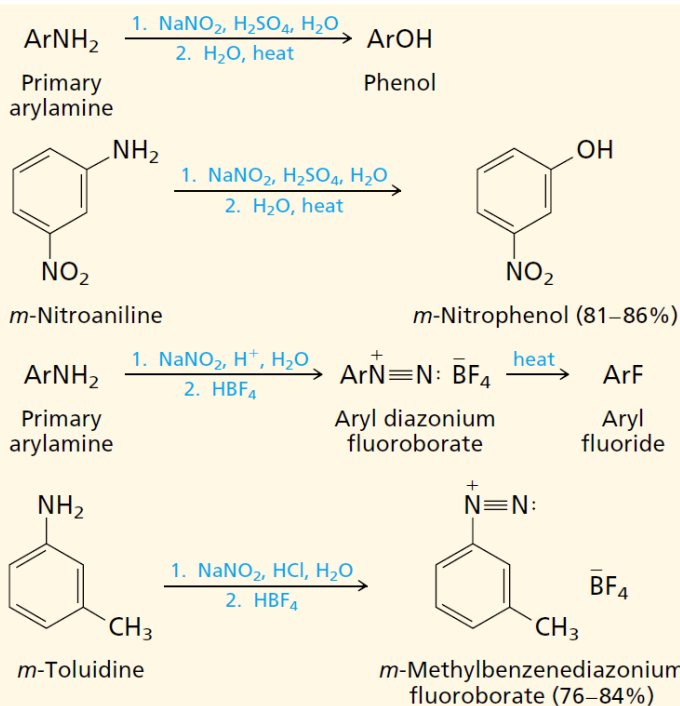
...doing
science
for better
health!



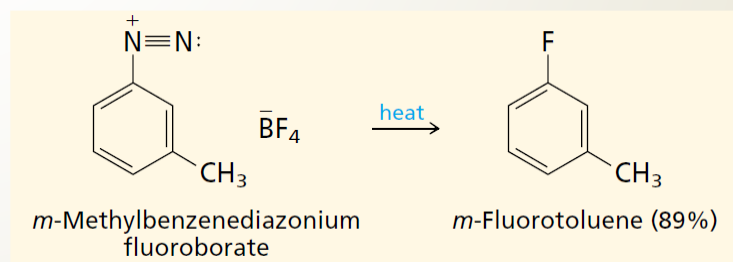
Nitrosação



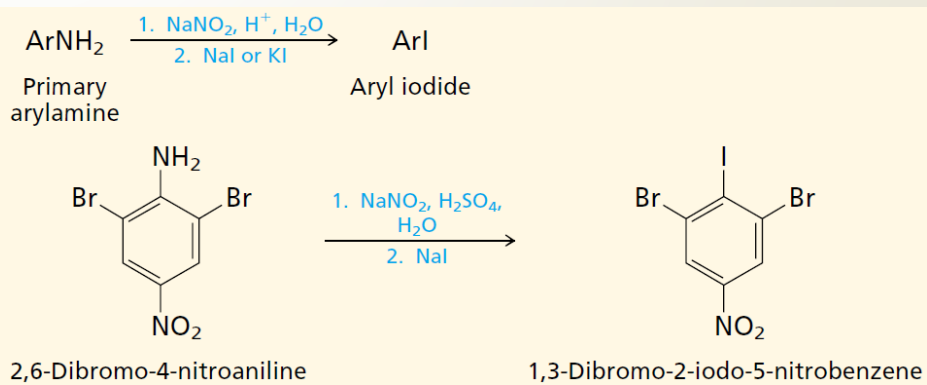
...doing
science
for better
health!



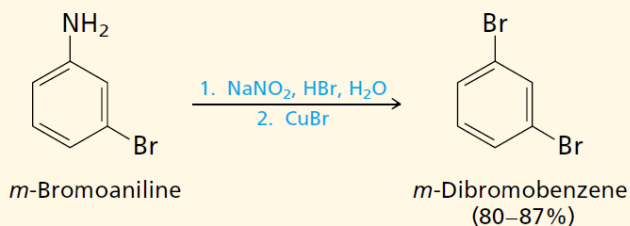
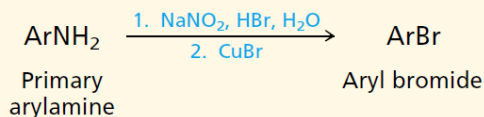
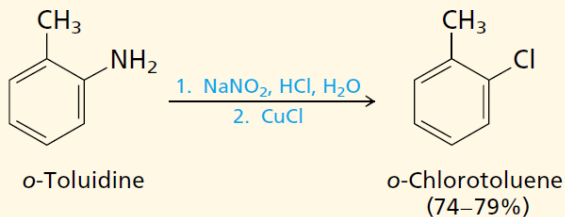
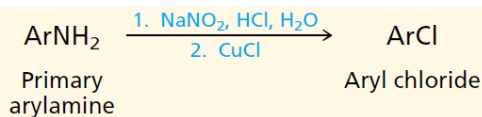
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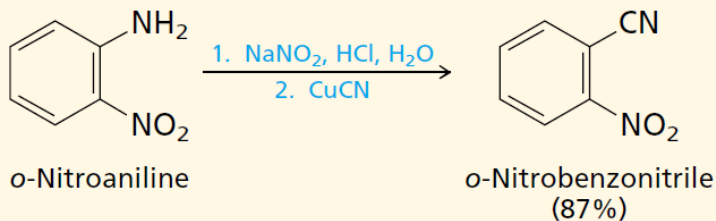
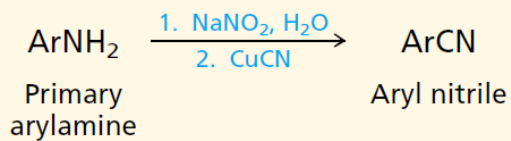
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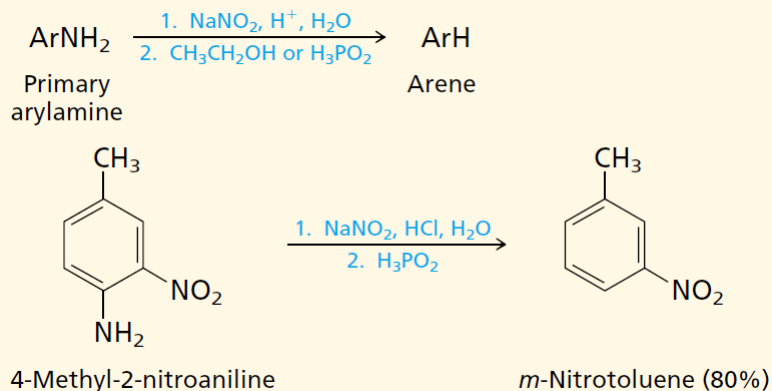


...doing
science
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health!





Desaminação redutiva de arilaminas primárias



Alquilaminas terciárias não têm efeito prático na nitroação

