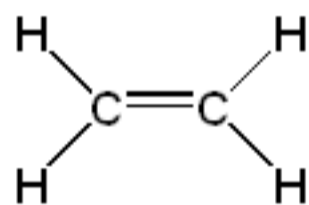
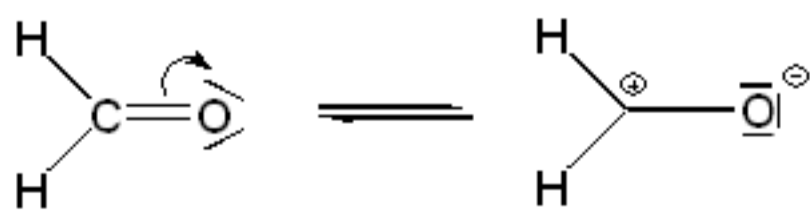


b)

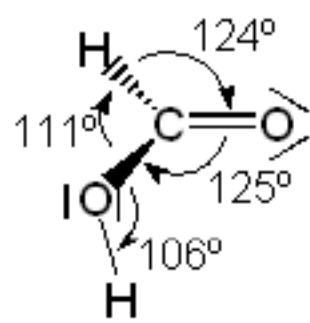
c)



a)

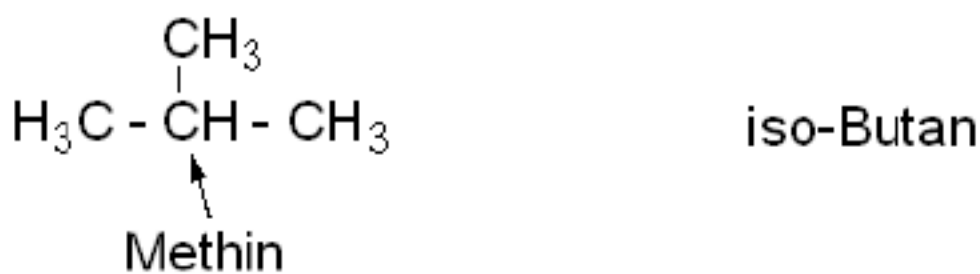
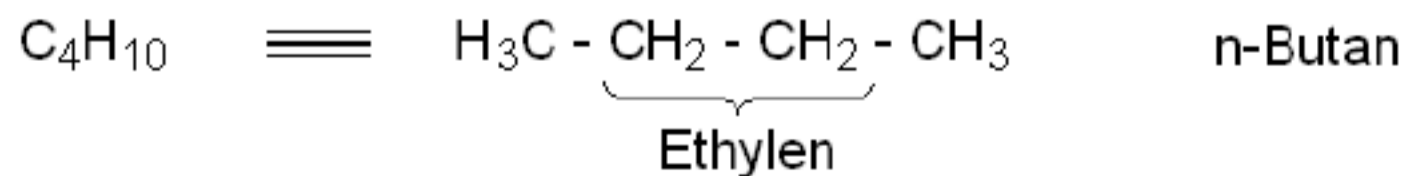
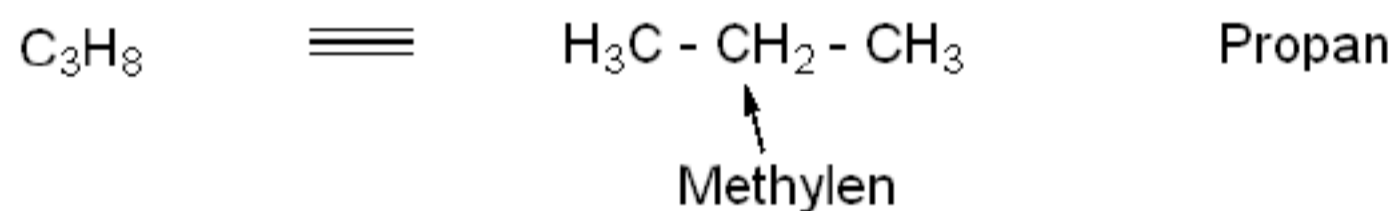
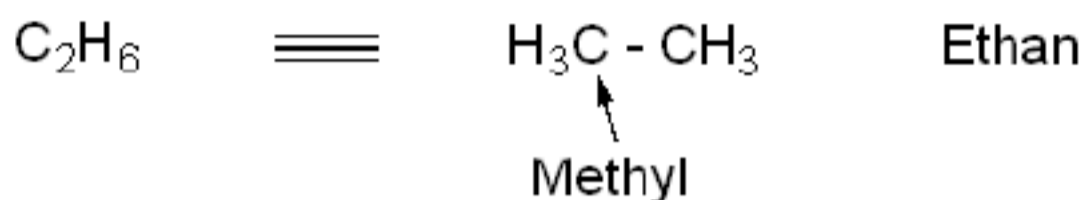
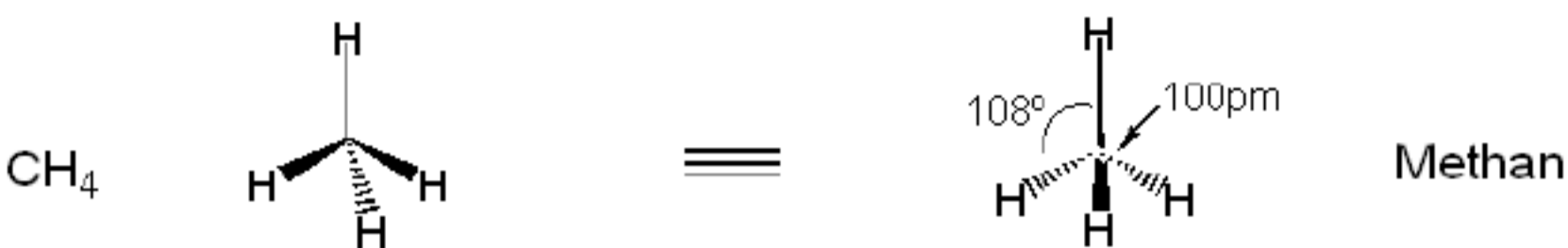


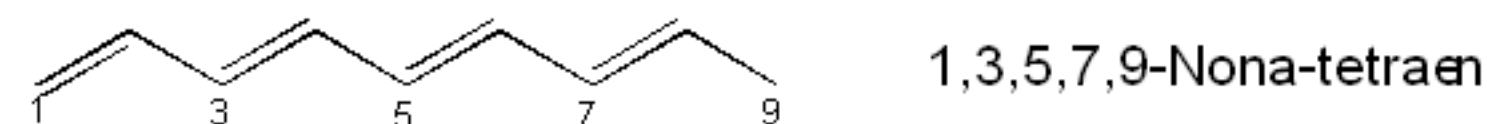
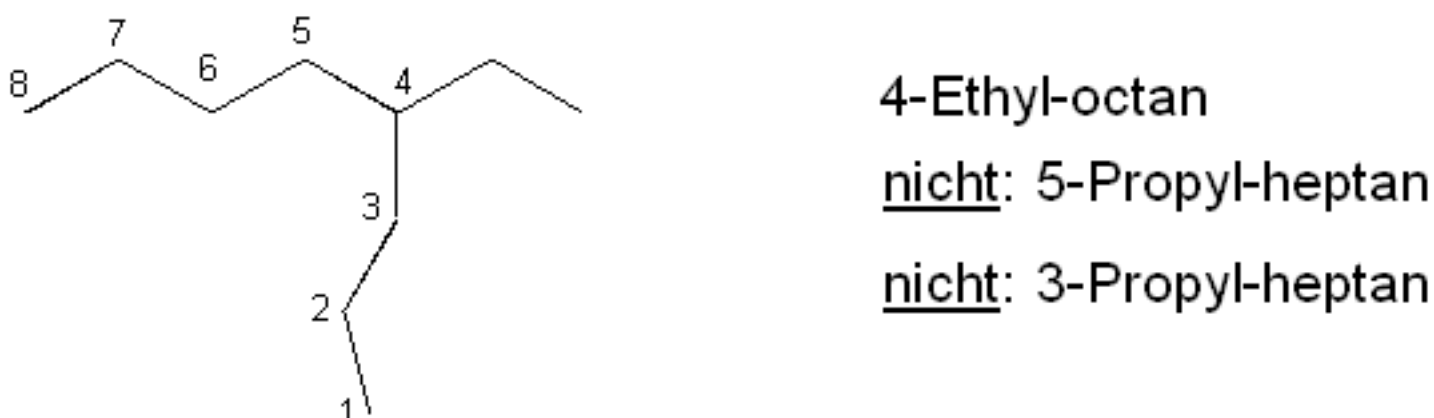
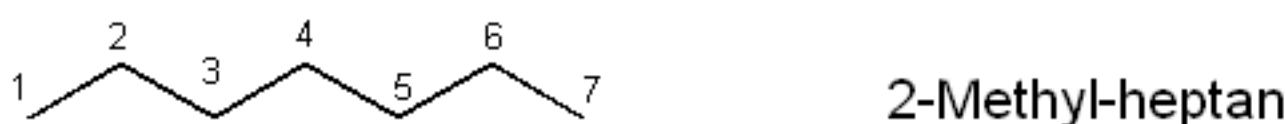
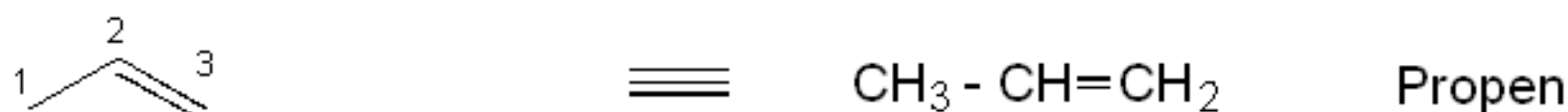
b)



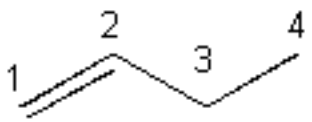
Kohlenwasserstoffe

(Einfachbindungen ~ 400-450 kJ/mol)

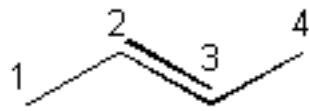




Alkene - Cycloalkane



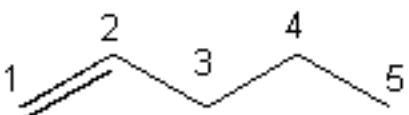
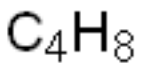
1-Buten



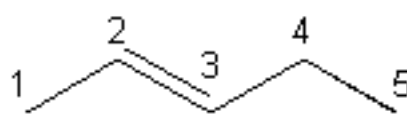
2-Buten



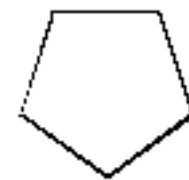
Cyclobutan



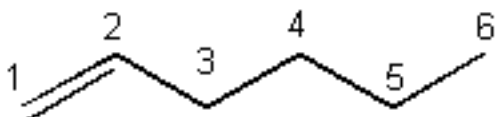
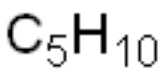
1-Penten



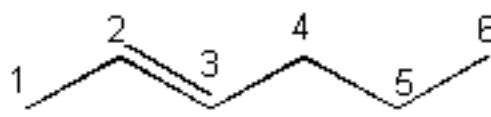
2-Penten



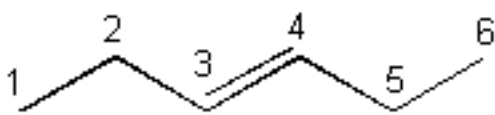
Cyclopentan



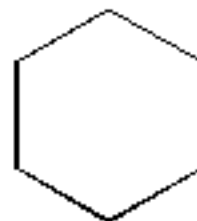
1-Hexen



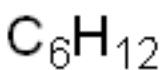
2-Hexen

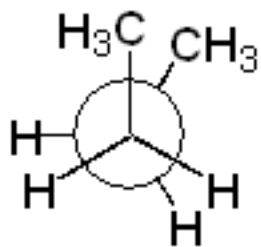


3-Hexen

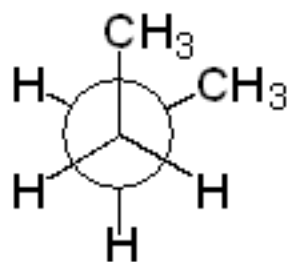


Cyclohexan

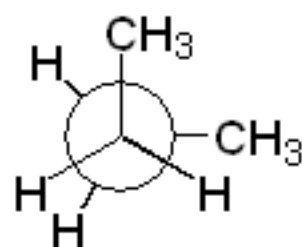




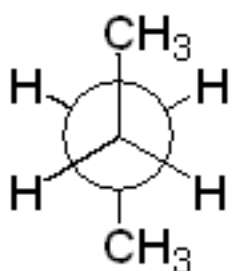
eekliptisch 0°



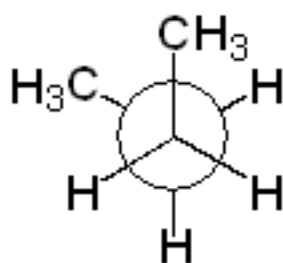
gauche 60°



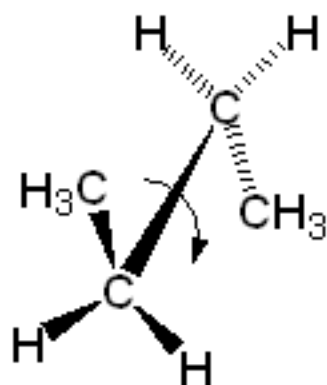
eekliptisch 120°



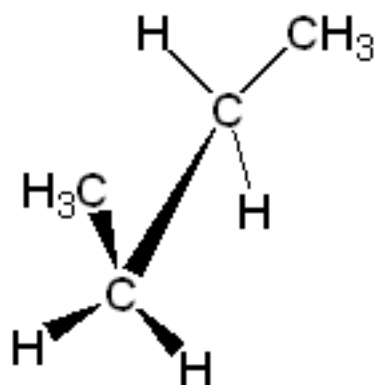
anti 180°



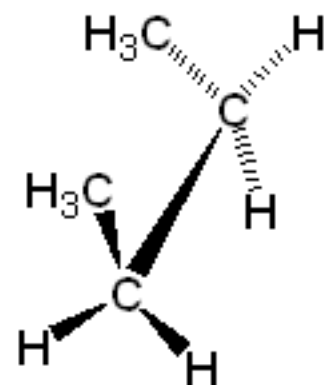
gauche 300°



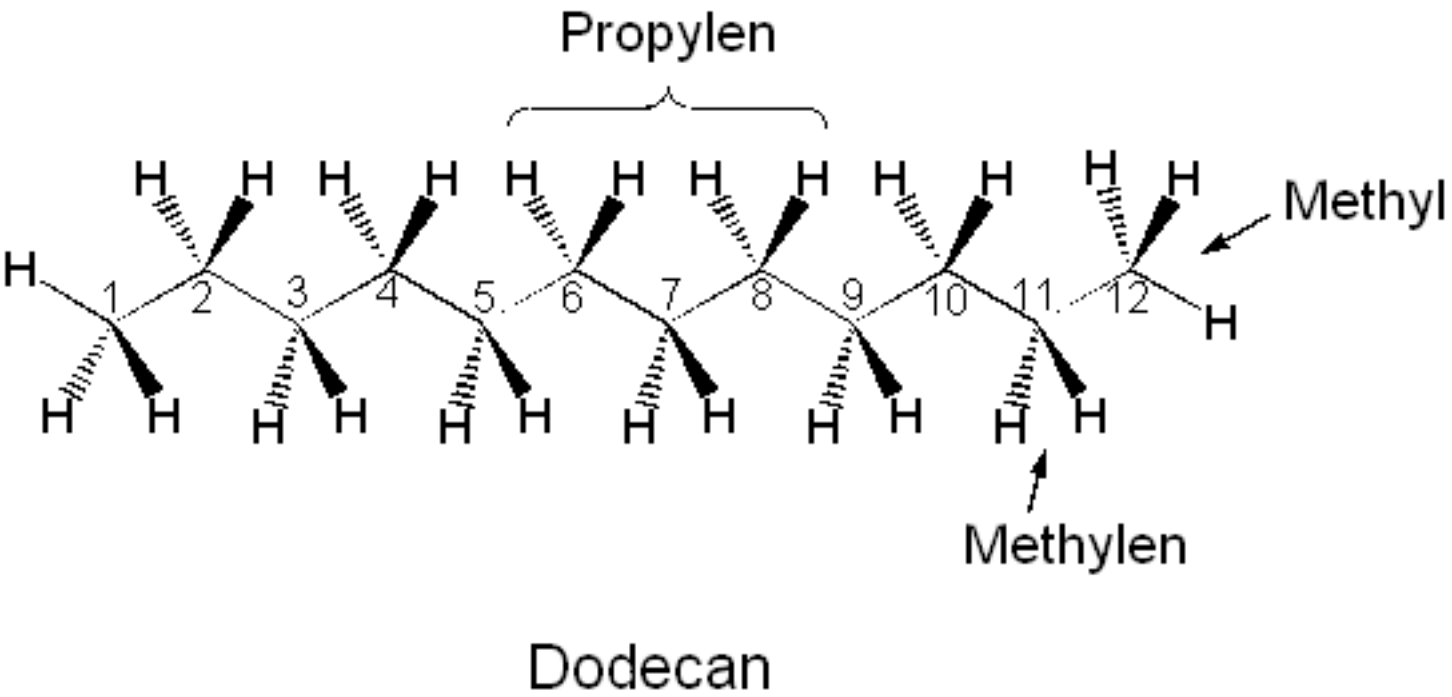
anti



gauche



gauche

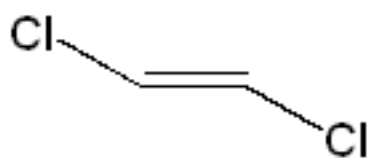


Diastereomere

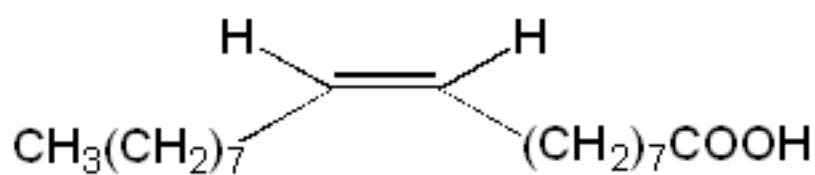
cis - trans Isomerie bei Olefinen



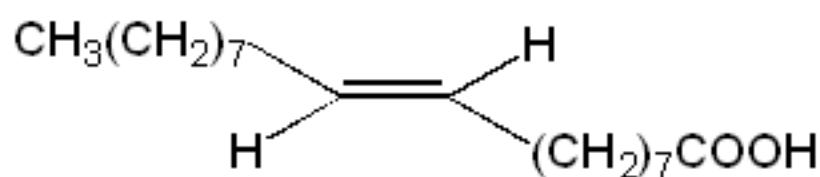
cis-Dichlorethen



trans-Dichlorethen

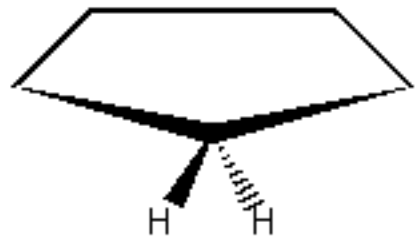


Ölsäure (cis)

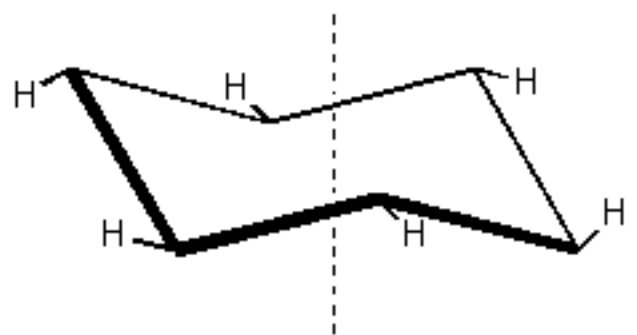
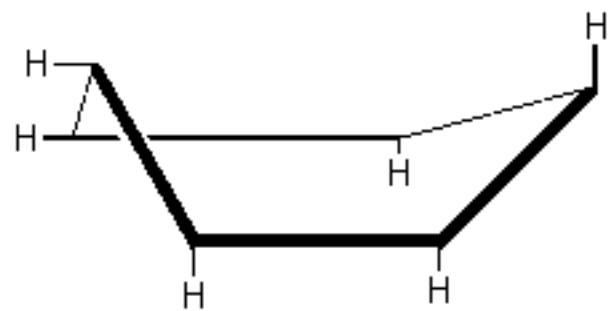
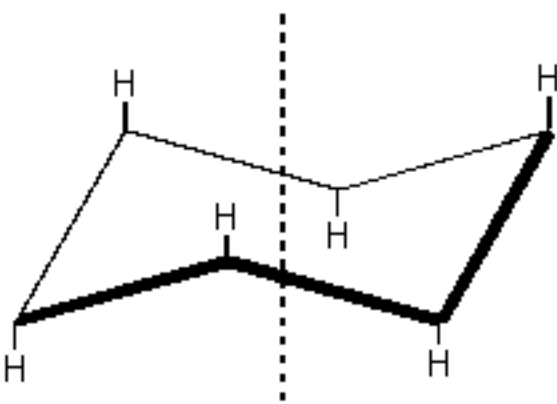
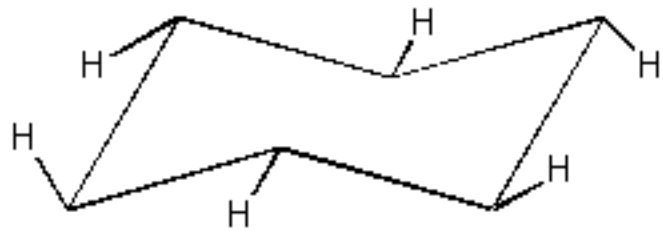
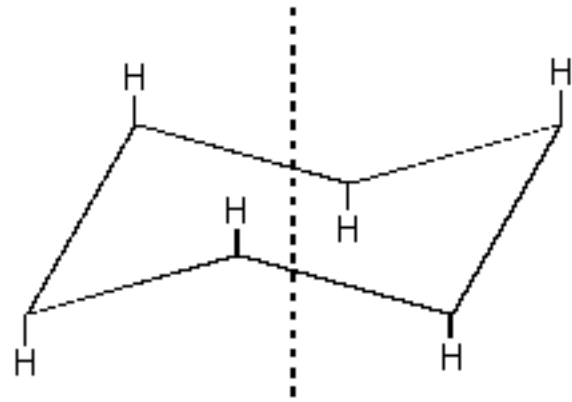
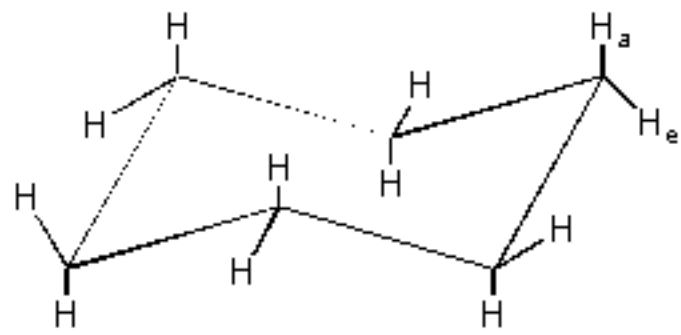


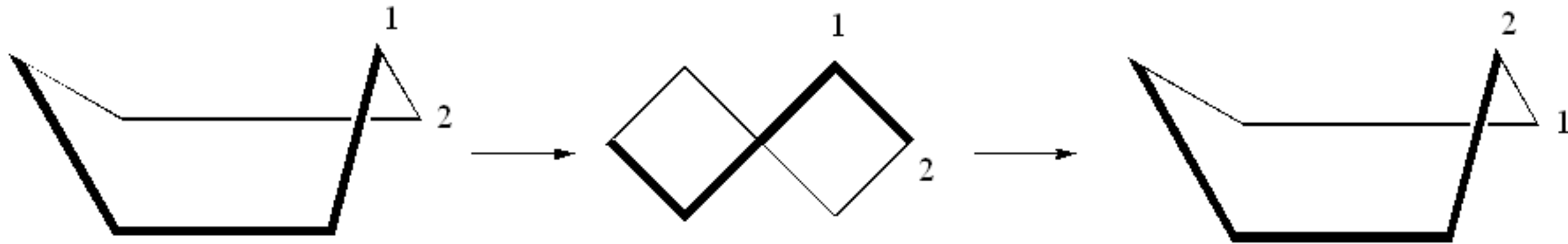
Elaidinsäure (trans)

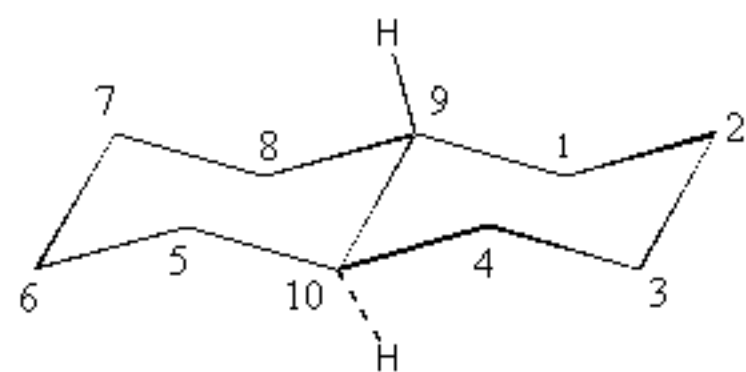
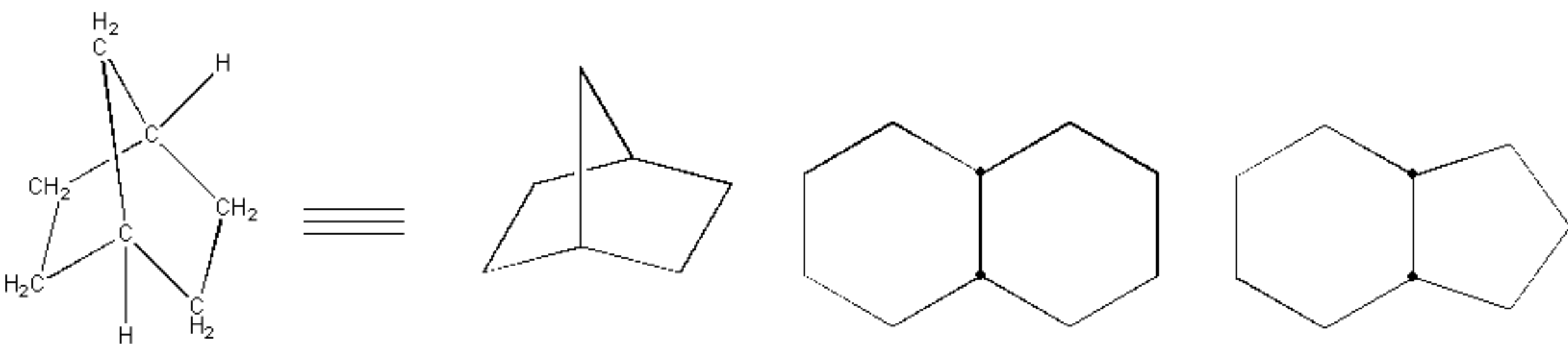
Cyclische gesättigte Kohlenstoffverbindungen



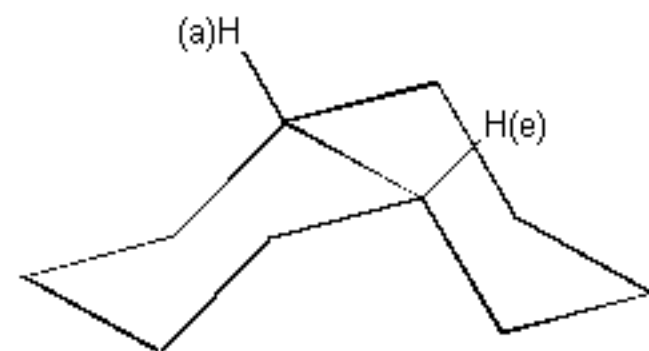
Cyclopentan
(nahezu planar)







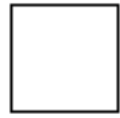
trans-Decalin



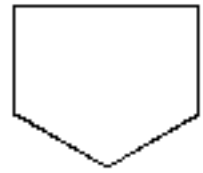
cis-Decalin



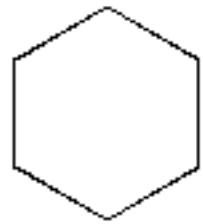
Cyclopropan



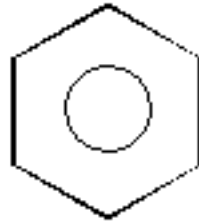
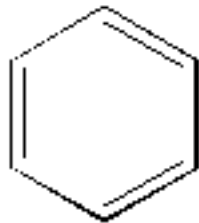
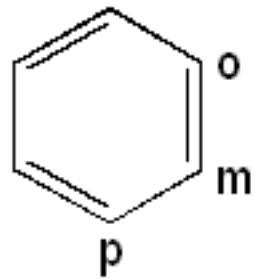
Cyclobutan



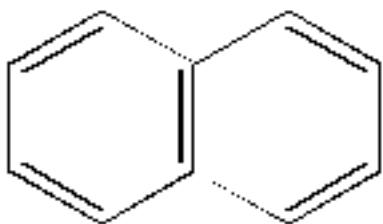
Cyclopentan



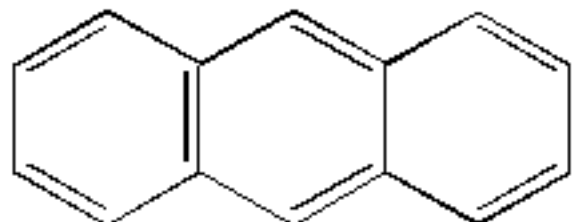
Cyclohexan



Benzol

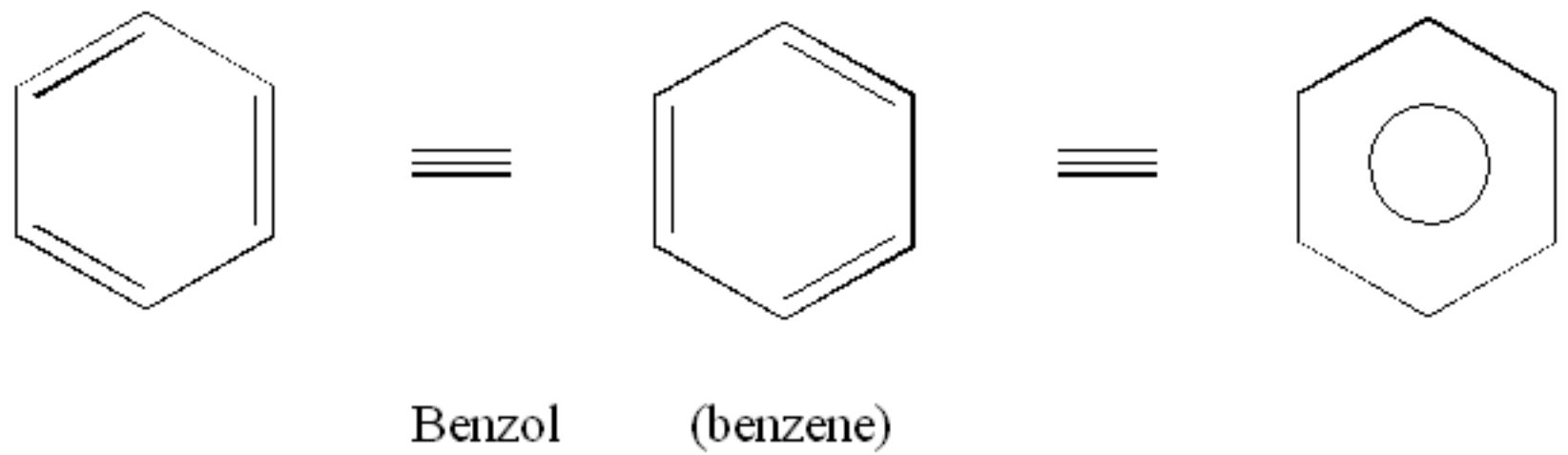


Naphthalin

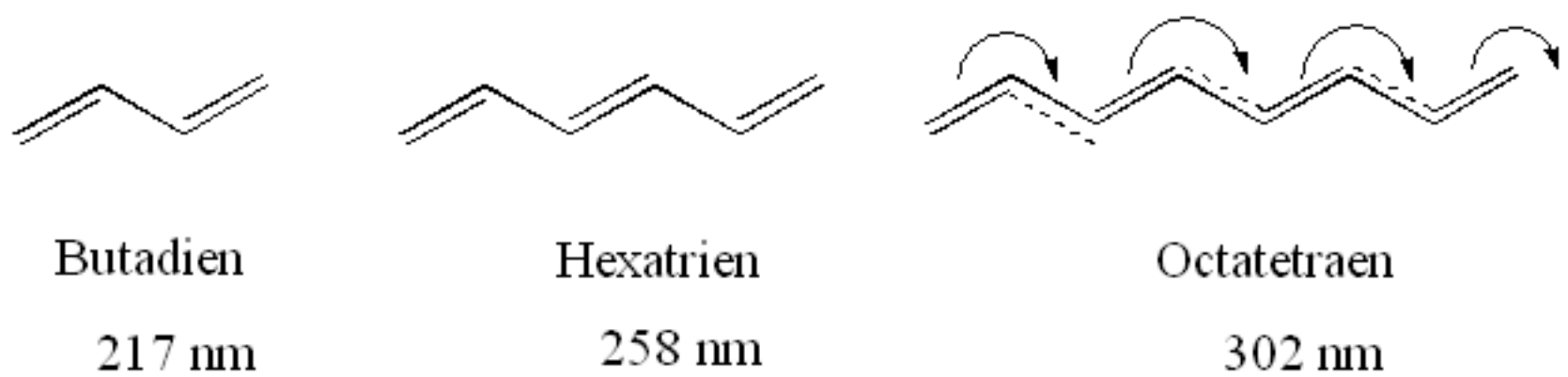


Anthracen

Aromat

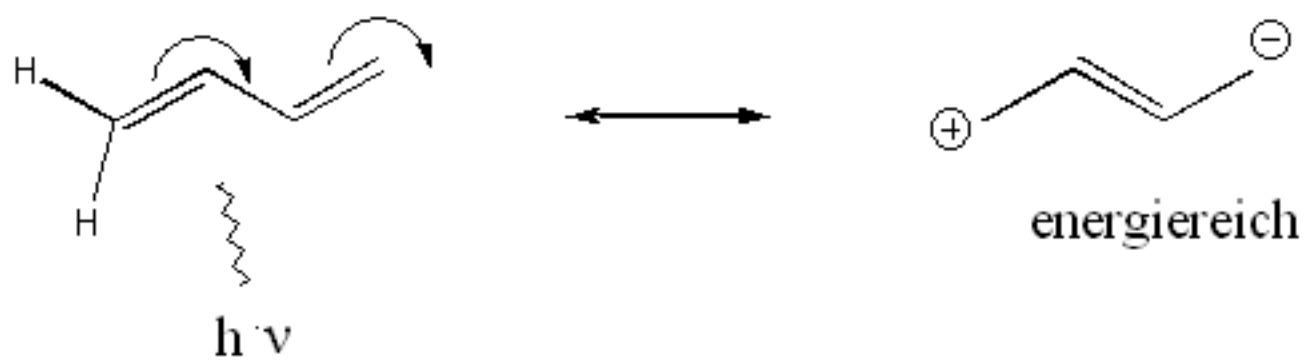


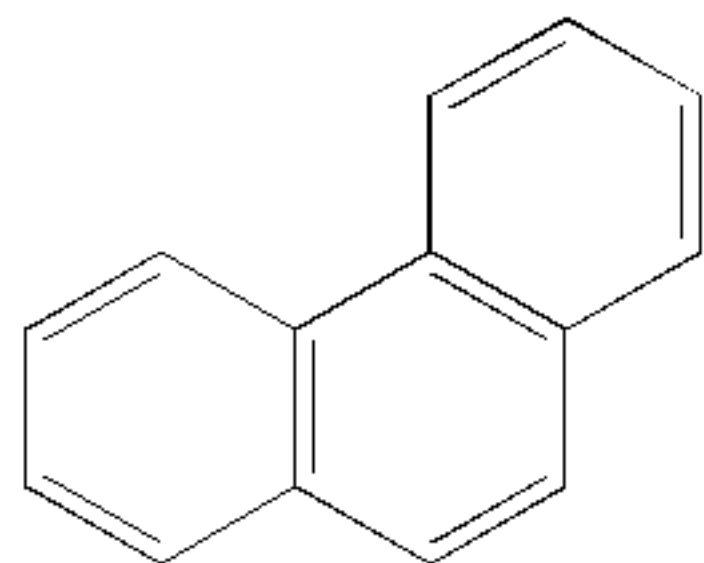
Polyene



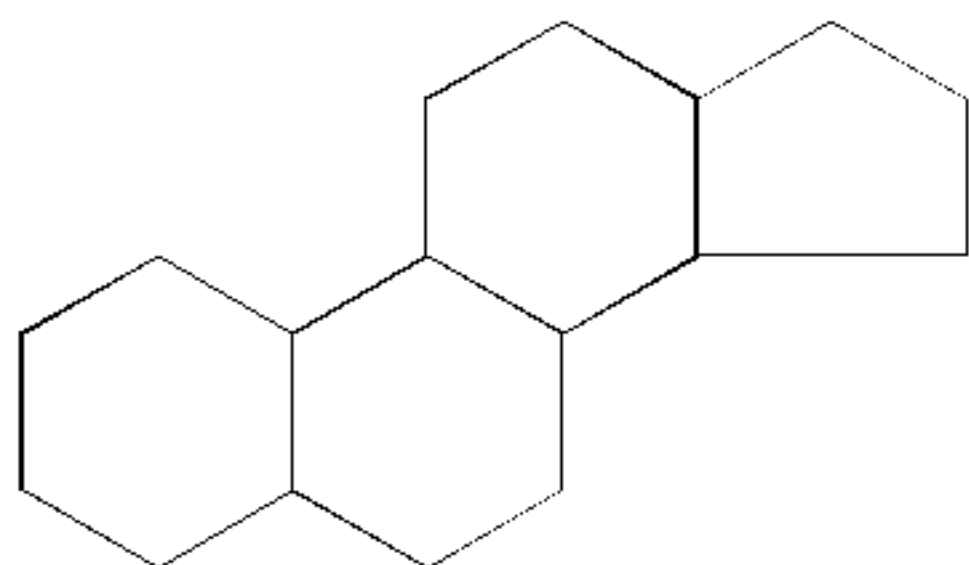
danach je Doppelbindung ca. +30 nm

Grenzwert ~ 600 - 700 nm

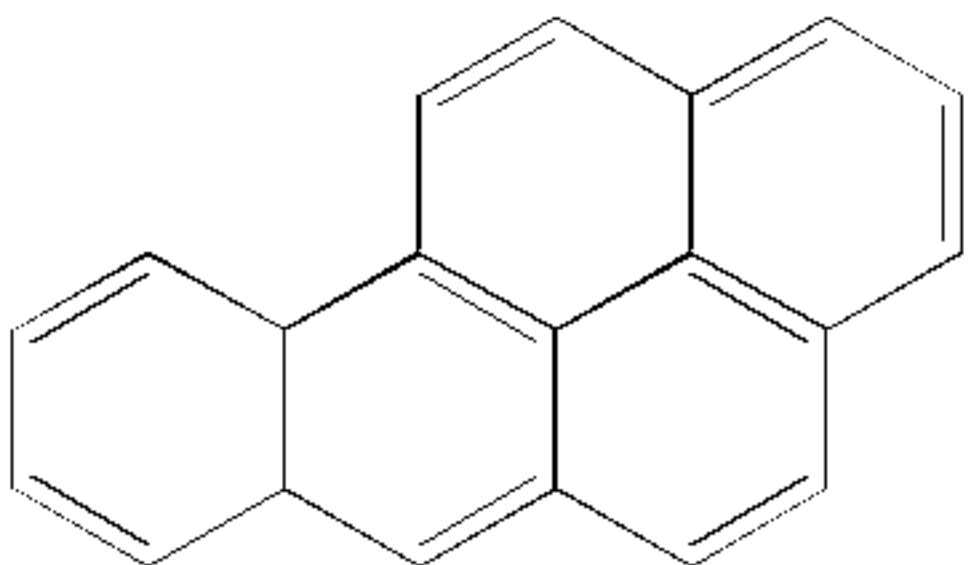




Phenanthren



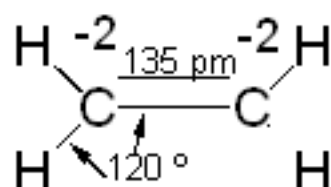
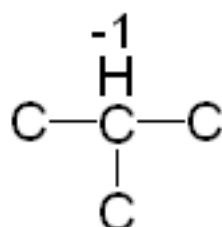
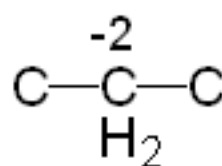
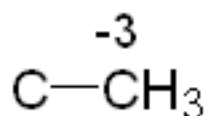
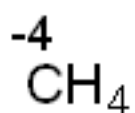
Steran, Gonau



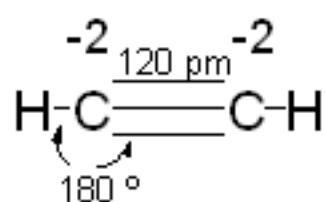
Benzpyren

Oxidationszahlen

Kohlenwasserstoffe

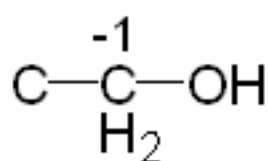


Ethen, Ethylen

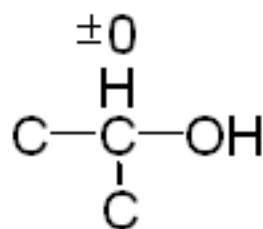


Ethin, Acetylen

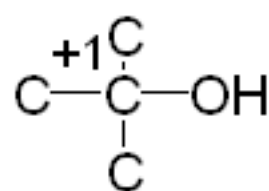
Alkohole



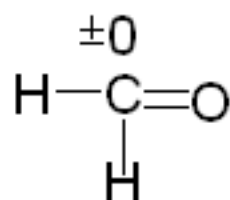
primär



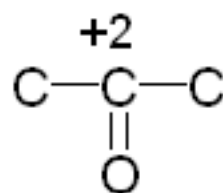
sekundär



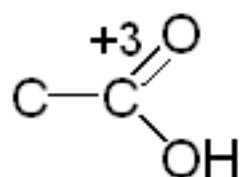
tertiär



Aldehyde
Formylgruppe

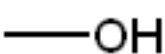


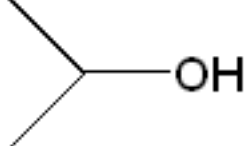

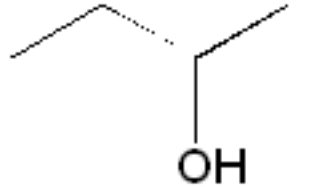
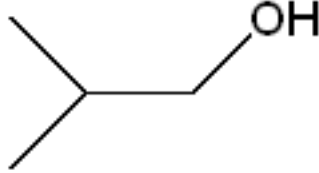
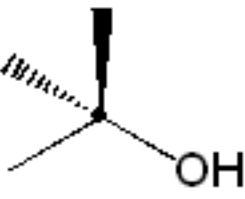
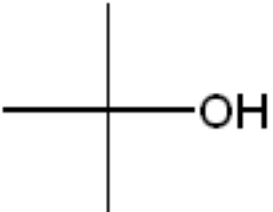
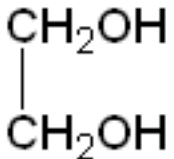

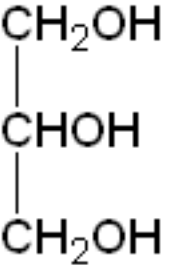
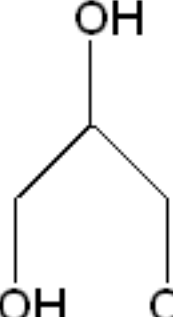


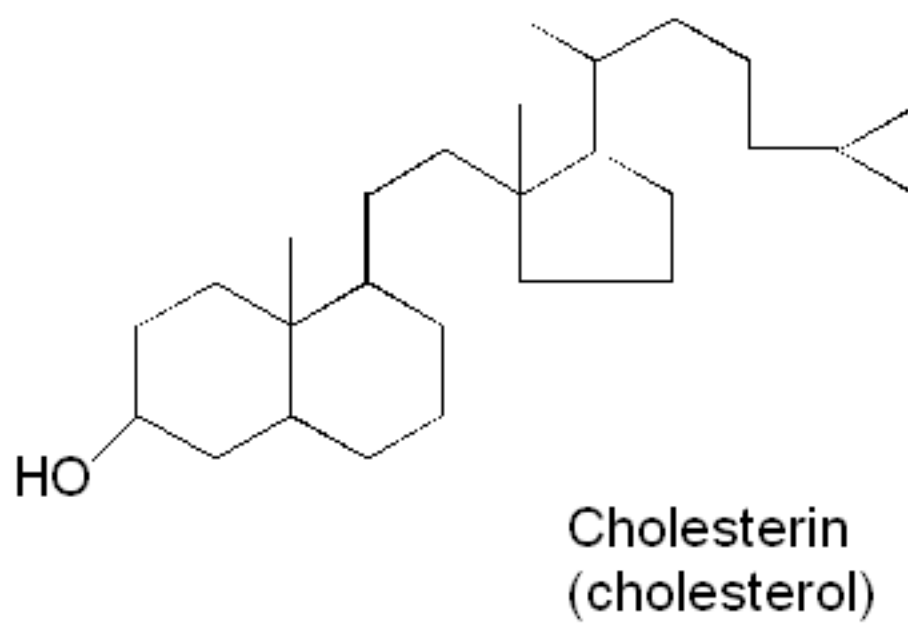
Ketone



Carbonsäuren
(Carboxyl)

Alkohole

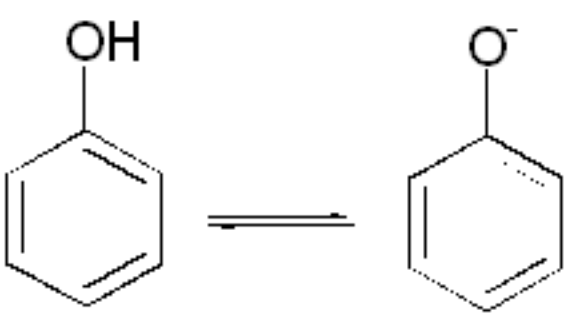
MeOH	≡		≡	CH ₃ OH	Methanol
EtOH	≡		≡	C ₂ H ₅ OH	Ethanol
			≡	C ₃ H ₇ OH	Propanol
			≡		iso-Propanol
			≡		n-Butanol (prim.)
			≡		n-Butanol (sek.)
			≡		iso-Butanol (prim.)
	≡		≡		tert.-Butanol
	≡		≡	Glycerol	(zweiwertig, prim.)
	≡		≡	Glycerol	(dreiwertig, sek. + prim.)



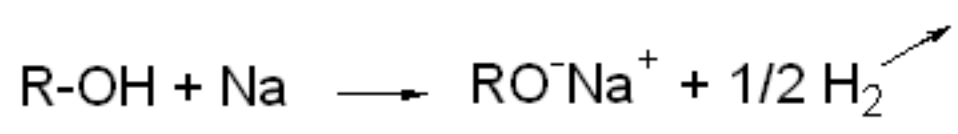
Reaktionen

$$pK_s = \text{pH} - \lg \frac{[A^-]}{[HA]}$$

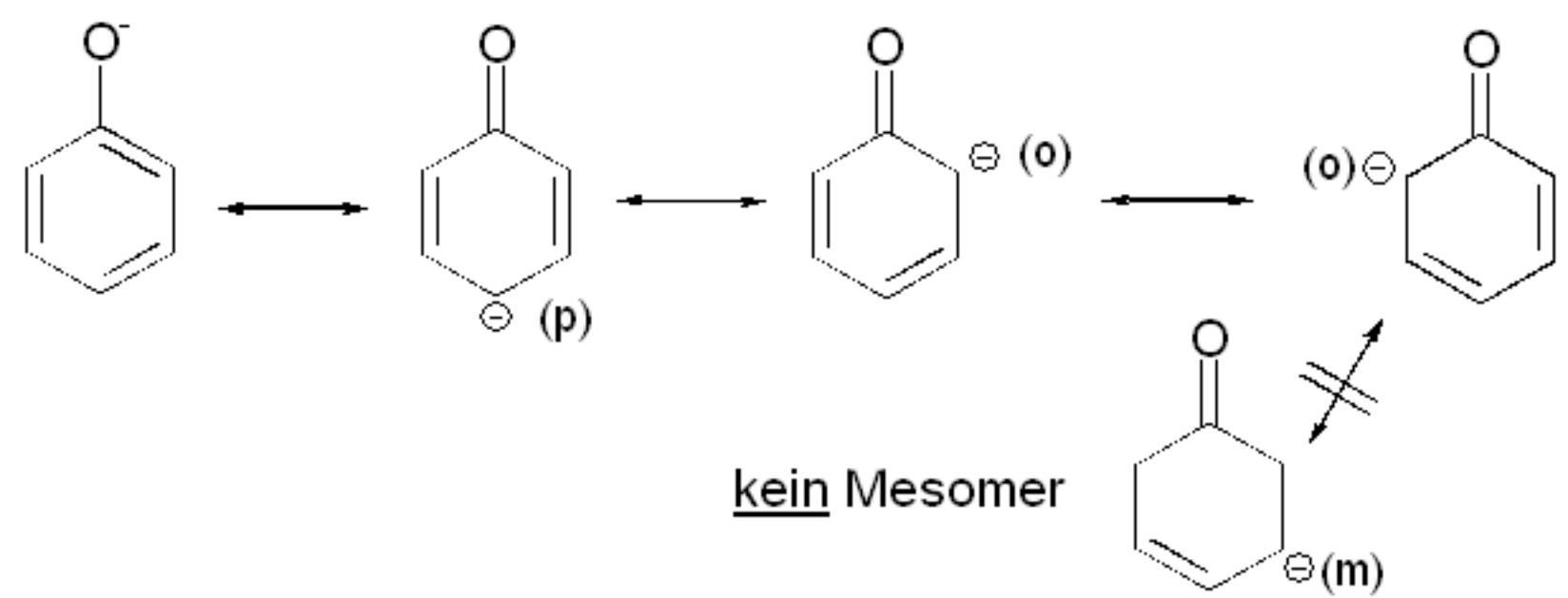
$$pK_{s \text{ A/HA}} \sim 16$$



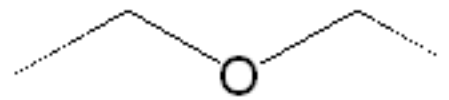
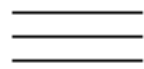
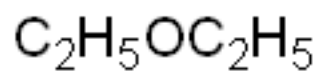
Phenol
 $pK_s \sim 10$



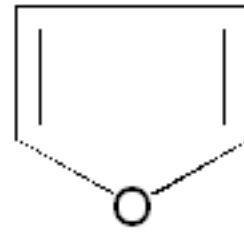
Phenolat



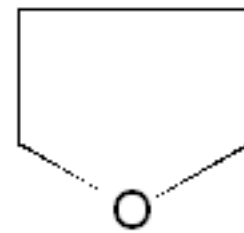
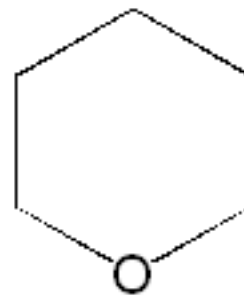
Ether



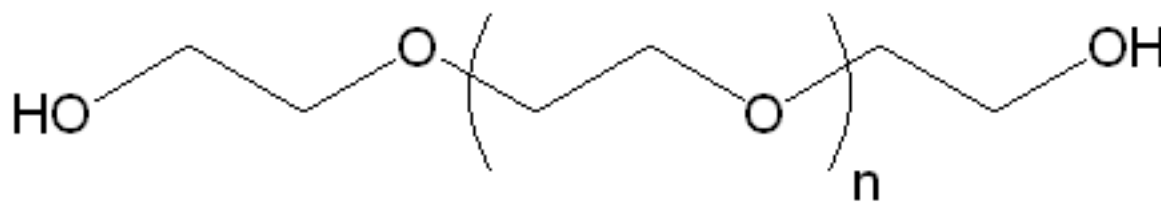
Diethylether



Furan

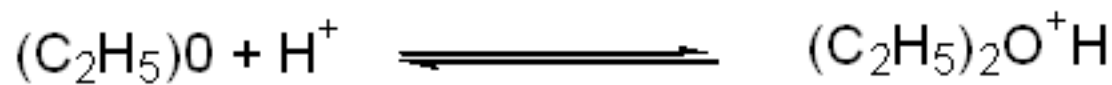
Tetrahydrofura
(THF)

Tetrahydropyran

Polyethyleneglycol
(PEG)

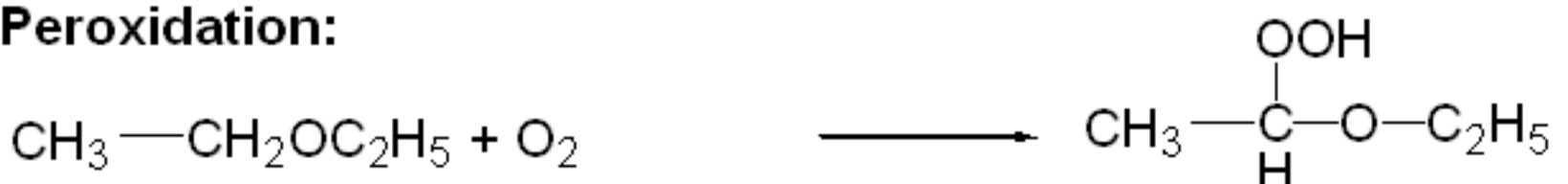
Reaktionen

Protonierung:

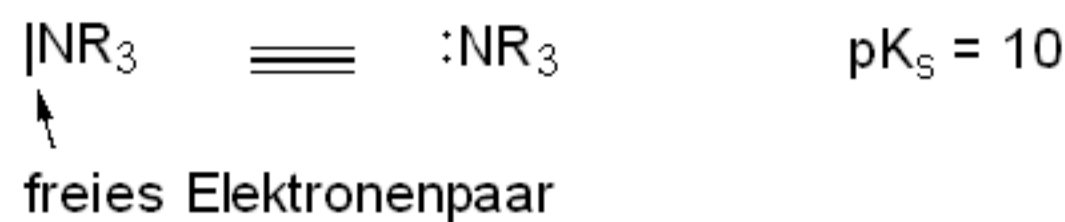


Oxoniumsalz
 $\text{p}K_{\text{S}} \approx -4$

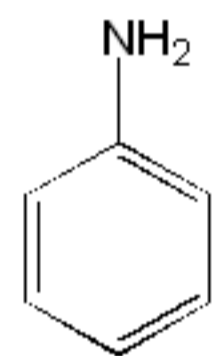
Peroxidation:



Amine



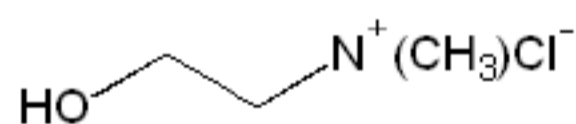
CH_3NH_2	Methylamin (primär)
$(\text{CH}_3)_2\text{NH}$	Dimethylamin (sekundär)
$(\text{CH}_3)_3\text{N}$	Trimethylamin (tertiär)
$(\text{CH}_3)_4\text{N}^+\text{Cl}^-$	Tetramethylammonium-chlorid (quartär)



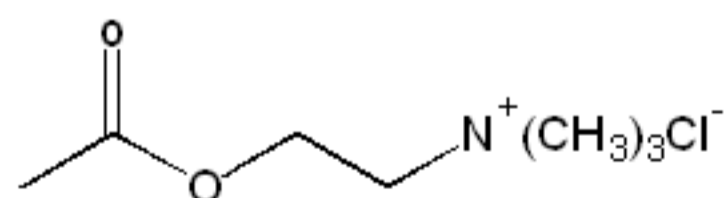
Anilin $\text{pK}_s \sim 5$



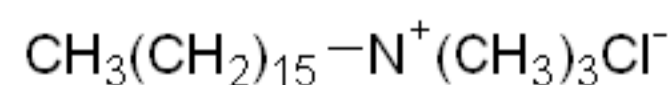
Ethanolamin (primär)



Chlorin-chlorid



Acetylcholin-chlorid

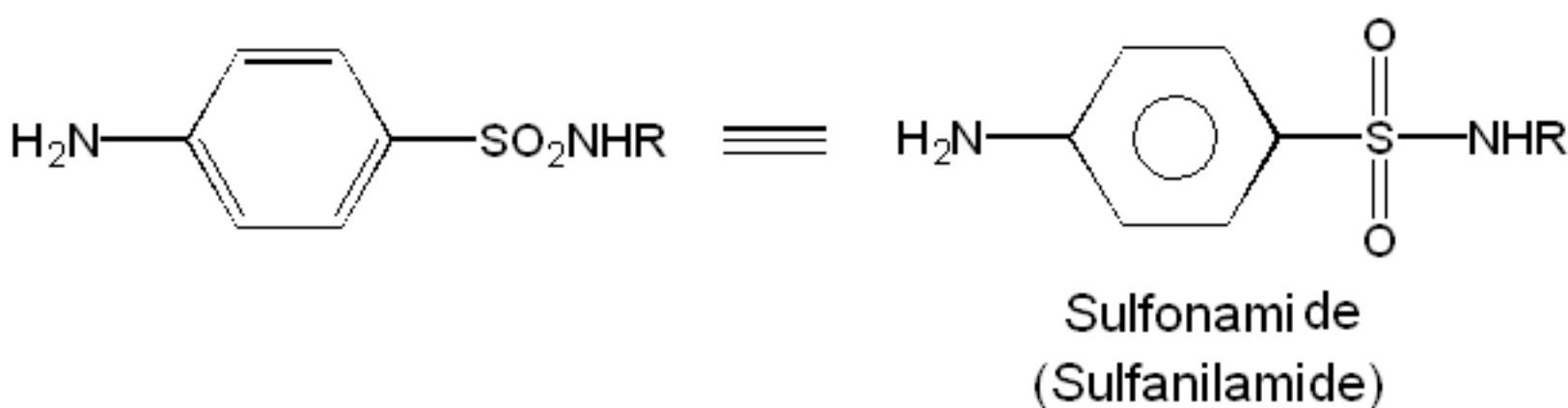
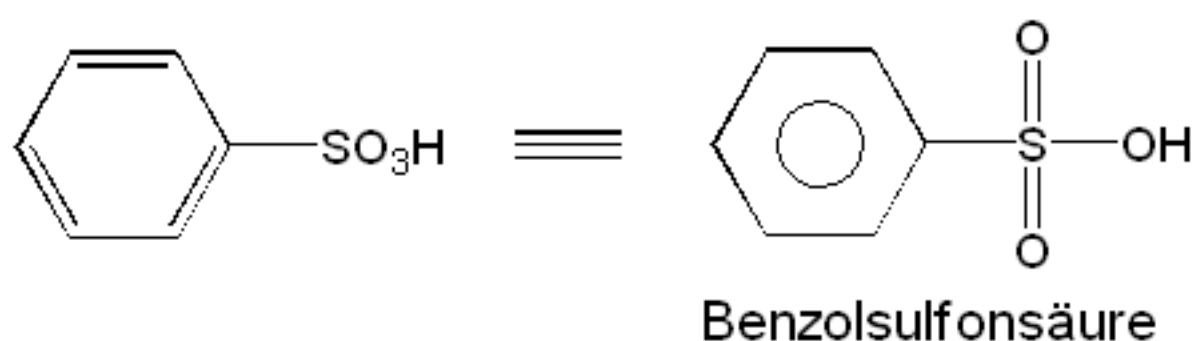
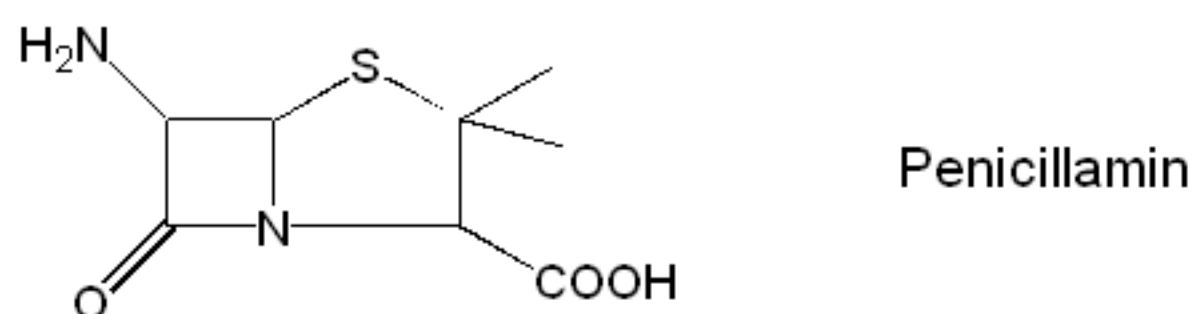
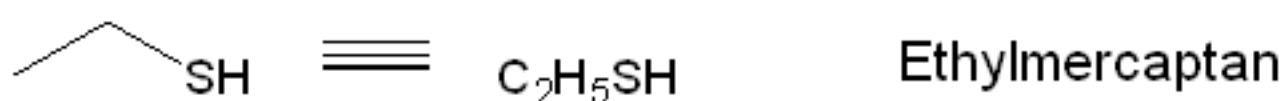


Trimethyl-cetyl-ammonium-chlorid
(Invertseife) quartär

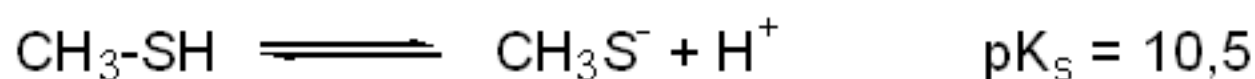
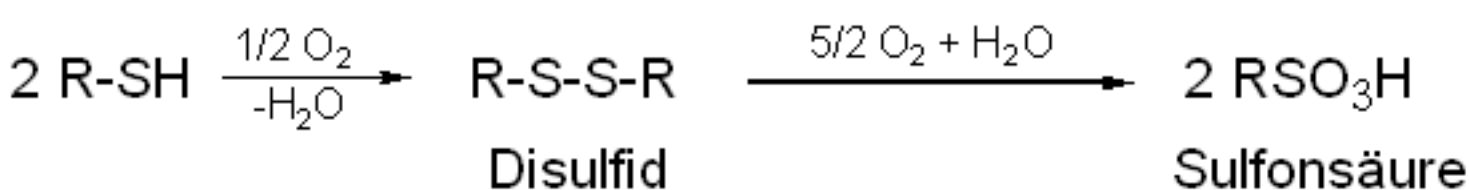
Reaktionen



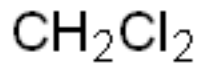
Mercaptane, Disulfide, Sulfonsäuren



Reaktionen



(F, Cl, Br, I)



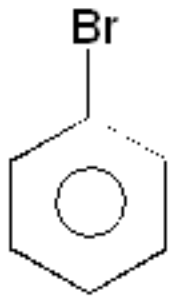
Methylenchlorid



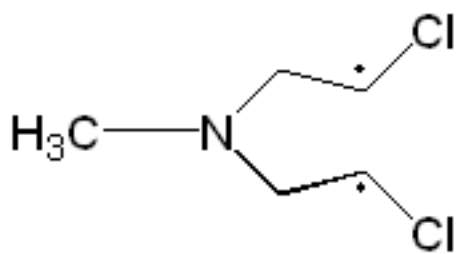
Chloroform



Tetrachlorkohlenstoff



Brombenzol



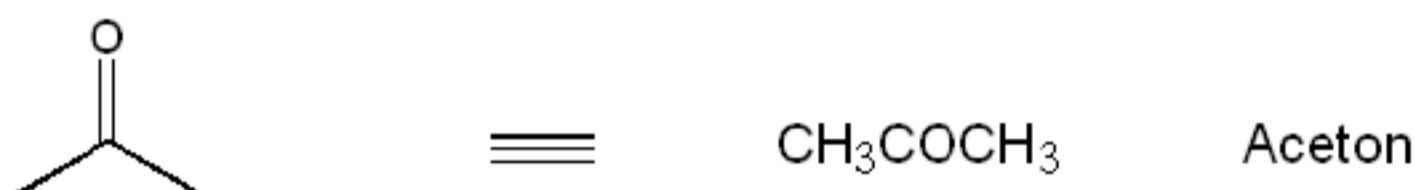
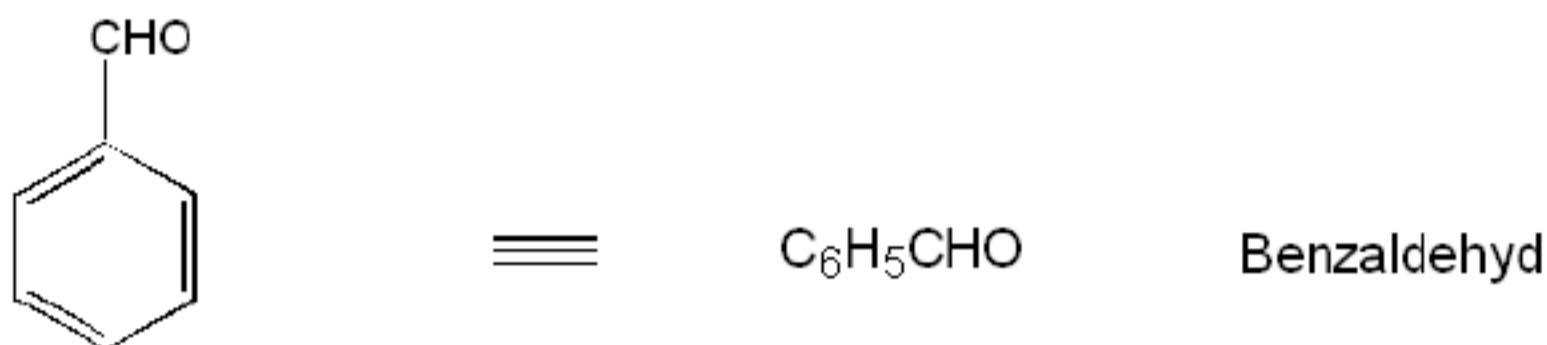
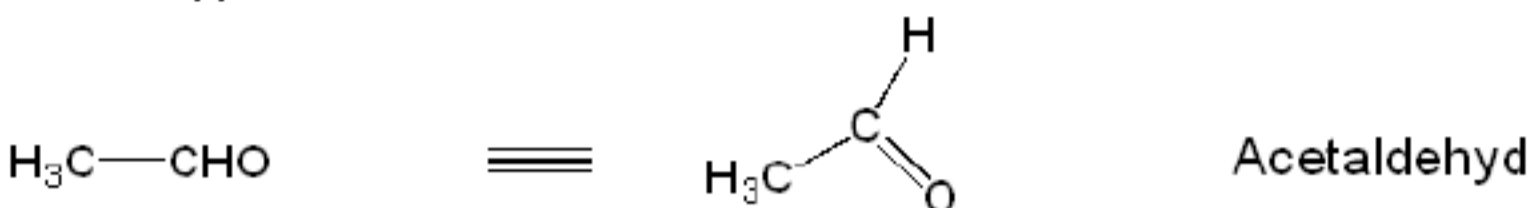
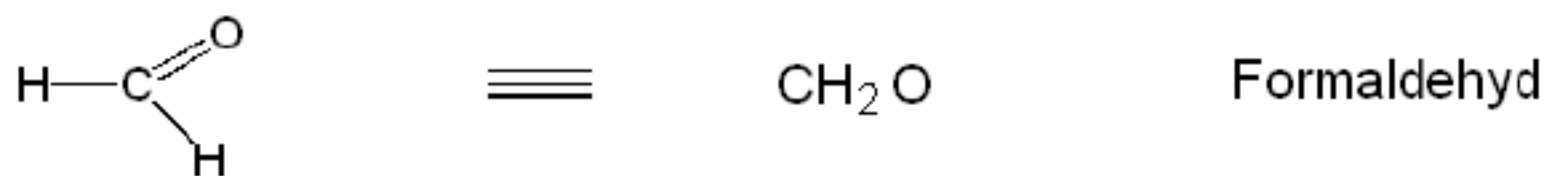
N-Lost

Reaktionen:

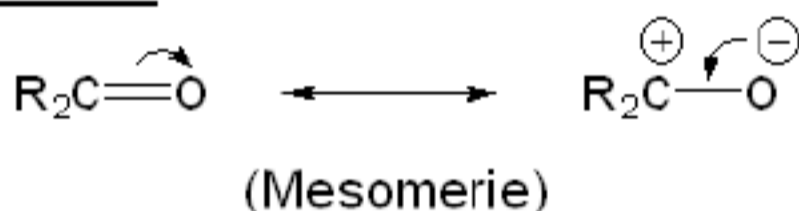


Nucleophile Substitution

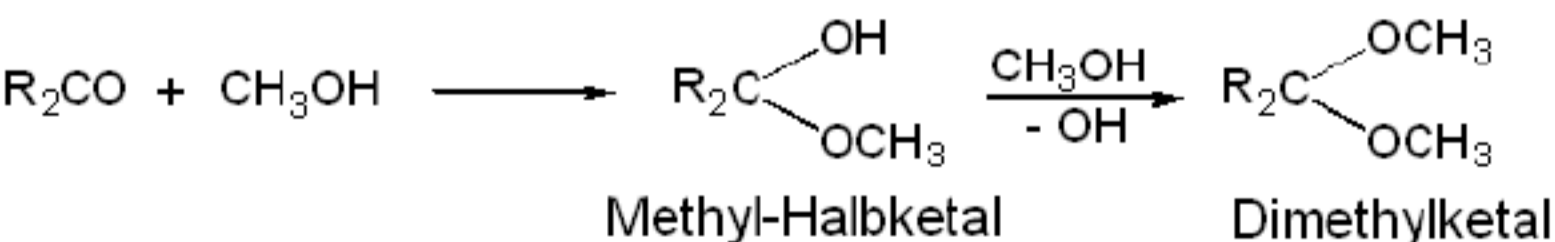
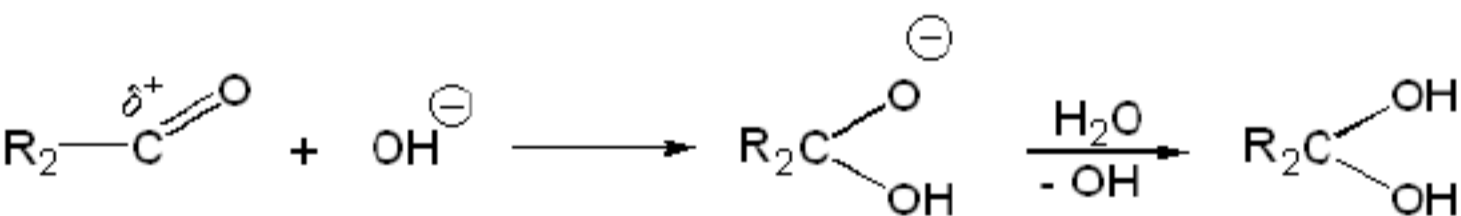
Aldehyde, Ketone



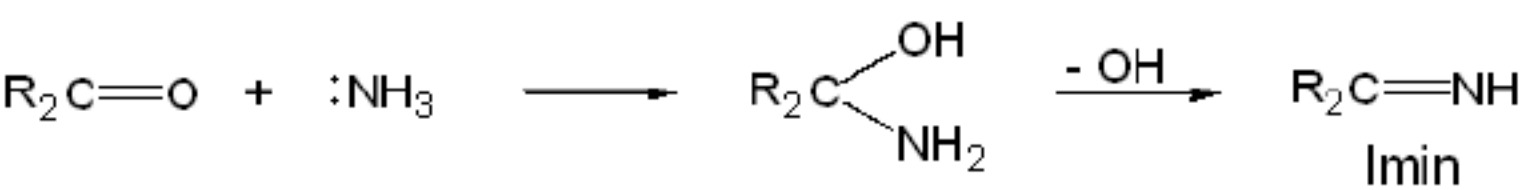
Reaktionen



Nucleophile Addition

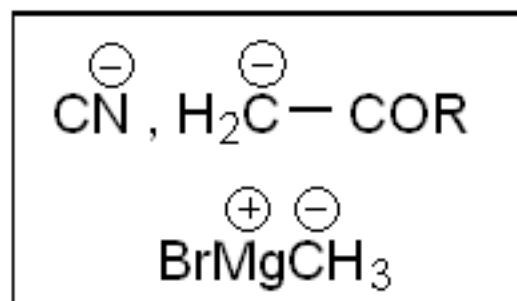
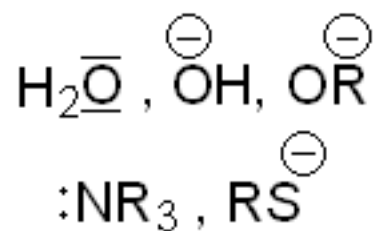


Addition-Eliminierung

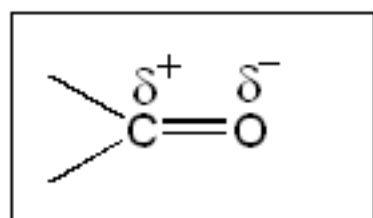
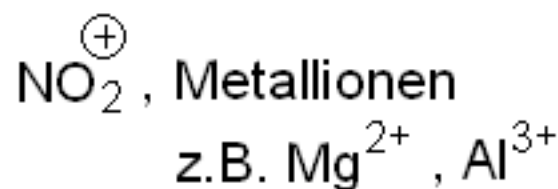


Reaktive Teilchen (Reagentien)

Nucleophile



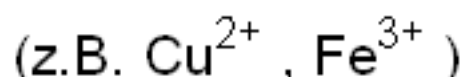
Elektrophile



Radikale



Paramagnetische Metallionen

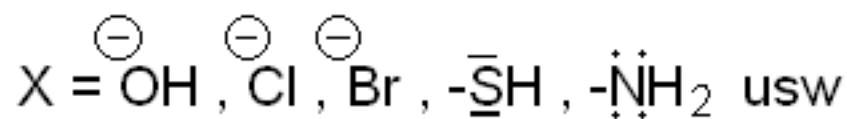
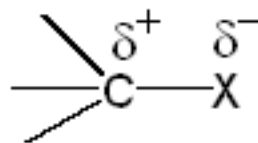


Organische Radikale von Heterocyclen

(Porphyrine, Flavine, Semichinone)

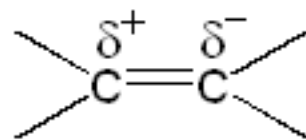
Polarisierung organischer Verbindungen

1. Unterschiede in der Elektronegativität (induktiver Effekt)



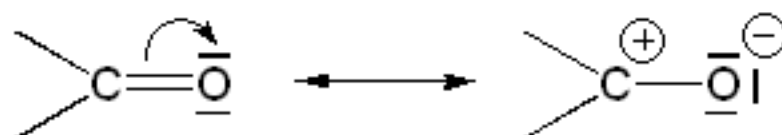
(ist elektrophil ; reagiert mit Nucleophilen)

2. π -Bindungen zu Kohlenstoffatomen



C ist nucleophil, reagiert mit Elektrophilen

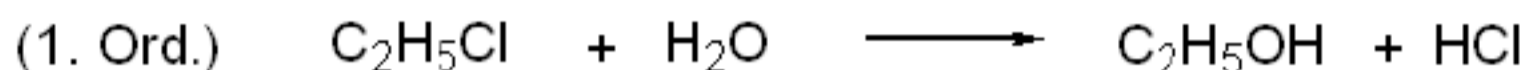
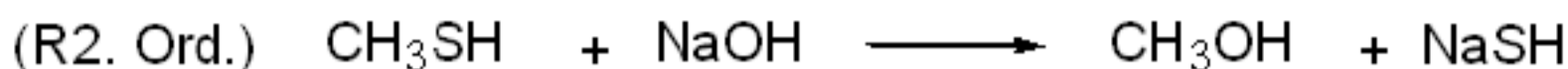
3. π -Bindungen zu Heteroatomen



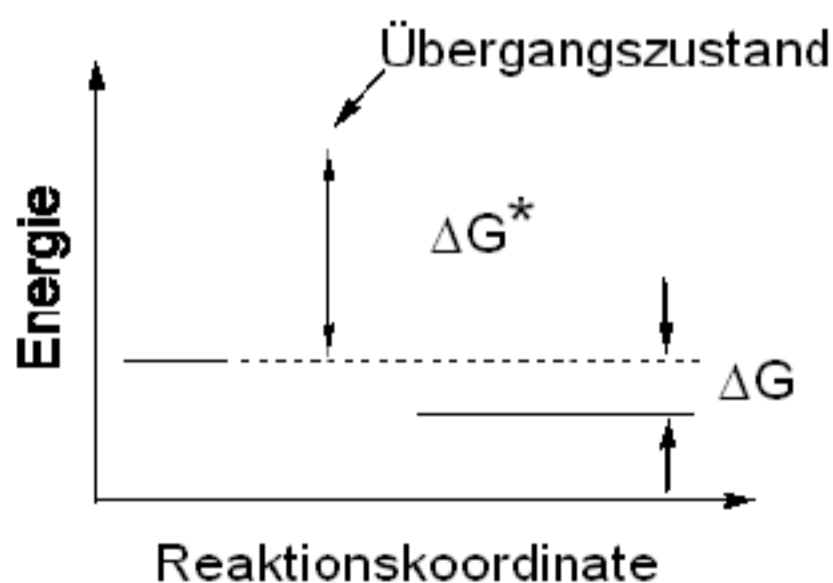
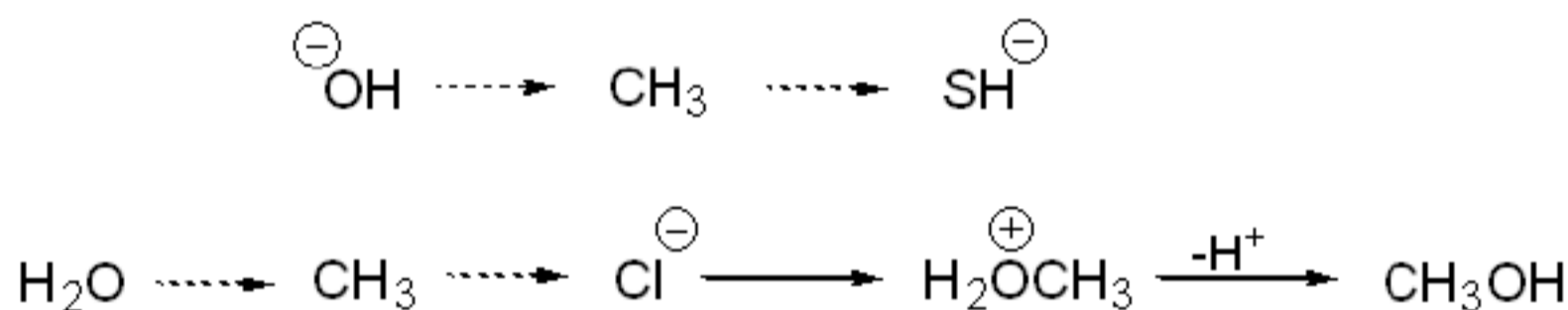
C ist elektrophil , reagiert mit Nucleophilen

Reaktionen von Alkoholen, Halogeniden und Sulfiden

Nucleophile Substitution



Übergangszustand



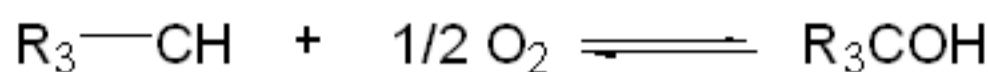
Kinetik

$$\frac{dc_A}{dt} = -k \cdot c_A \quad (1. \text{ Ordnung})$$

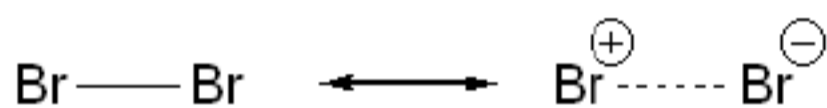
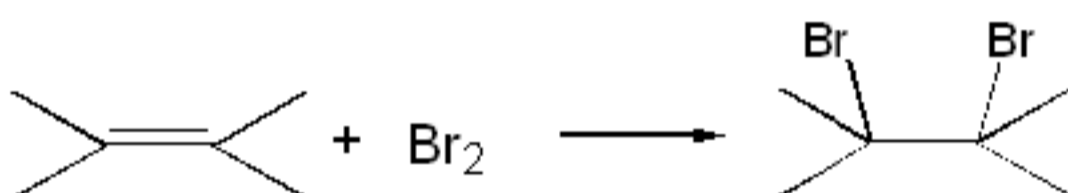
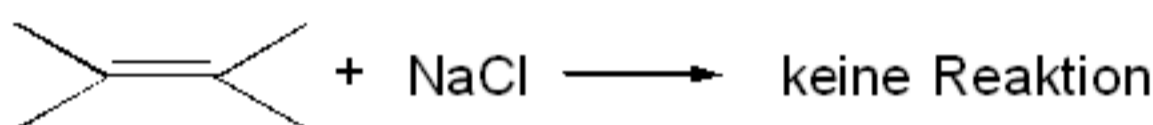
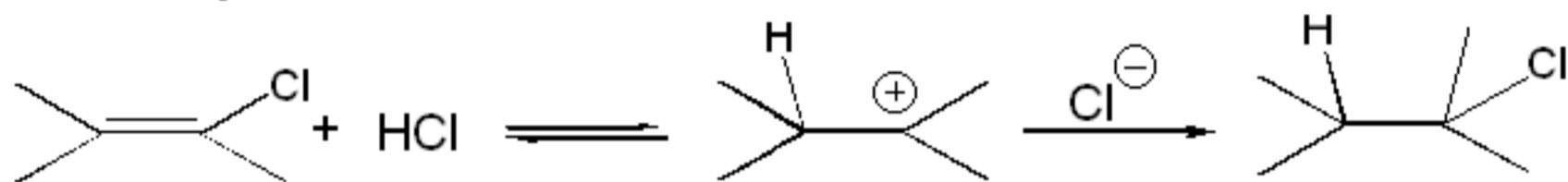
$$\frac{dc_A}{dt} = -k \cdot c_A \cdot c_B \quad (2. \text{ Ordnung})$$

Reaktionen von Kohlenwasserstoffen

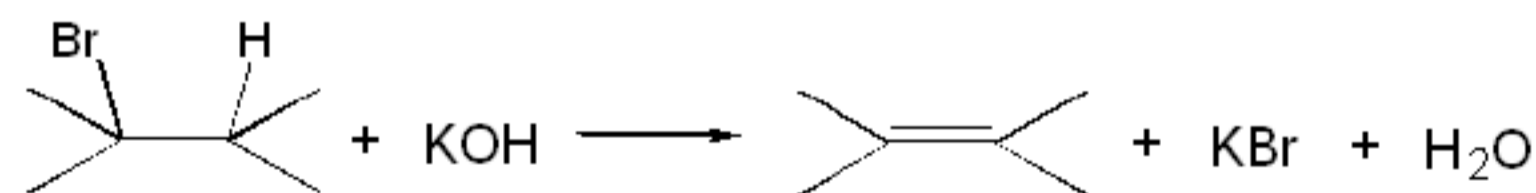
Oxidation



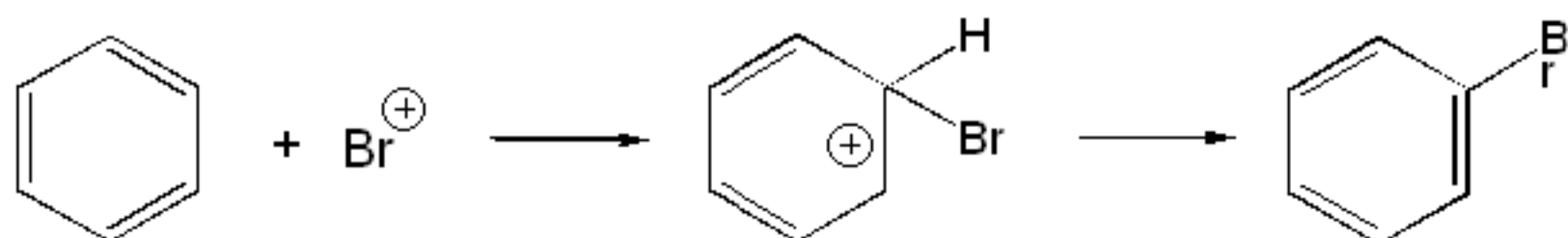
Elektrophile Addition



Eliminierung



Elektrophile Substitution

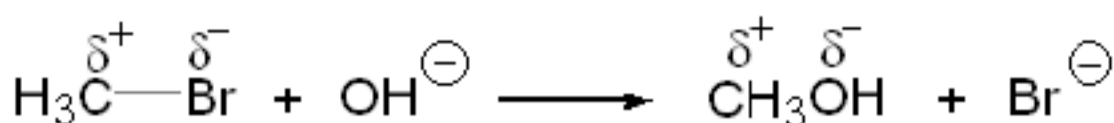


Resonanzenergie Benzol: $\sim 150 \text{ kJ mol}^{-1}$

Reaktionen

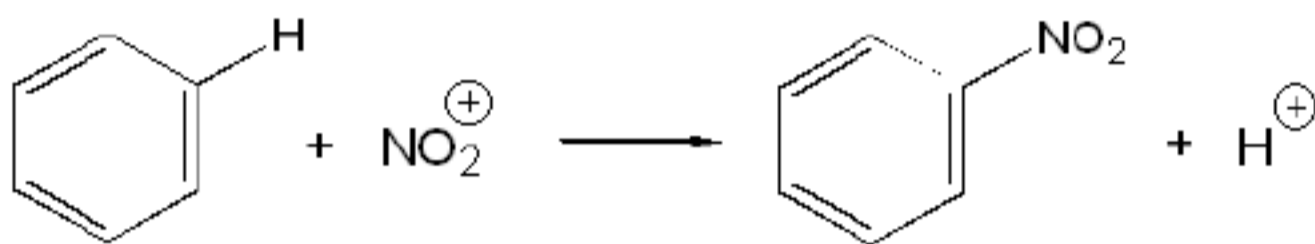
Substitution

nucleophil



Substrat Reagenz

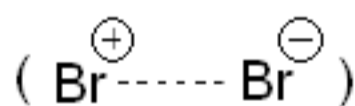
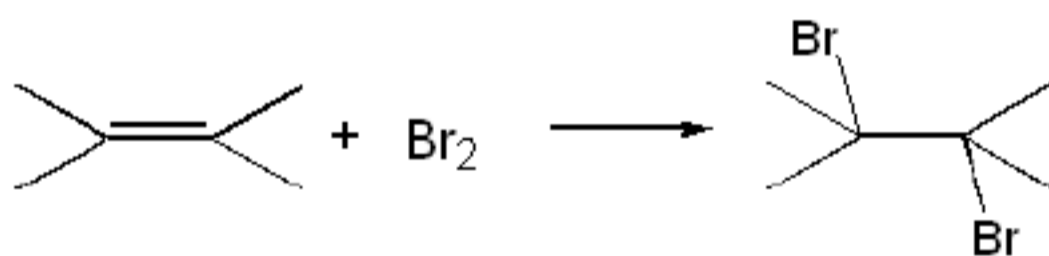
elektrophil



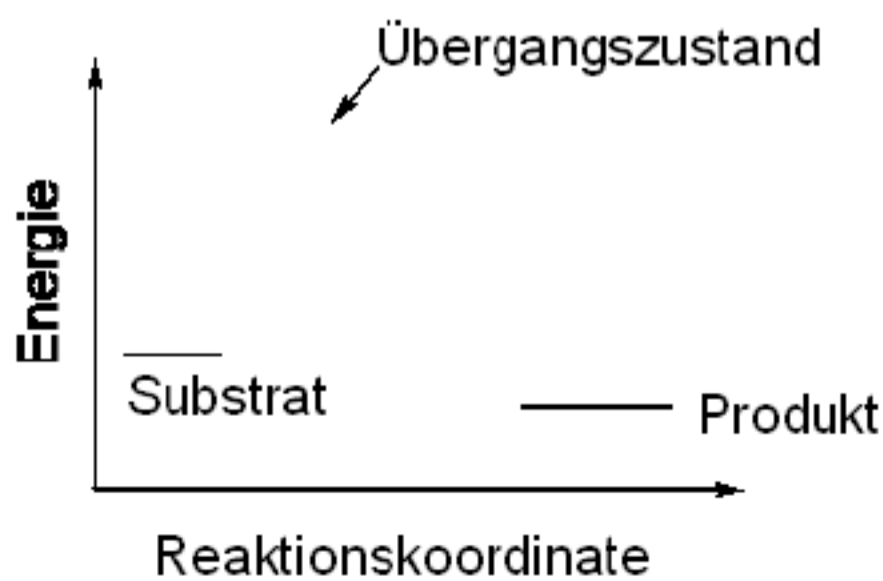
Substrat Reagenz

Addition

elektrophil

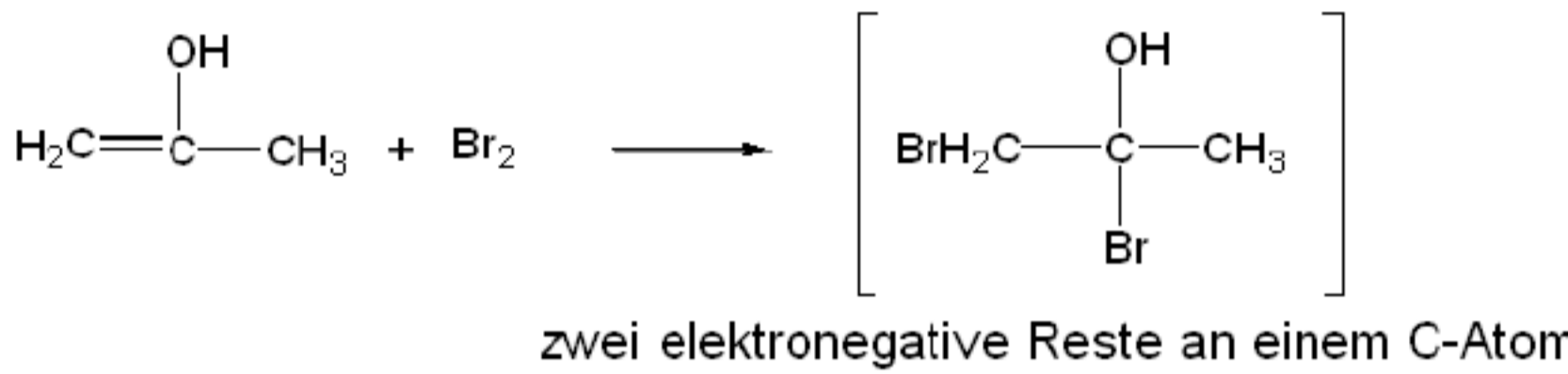
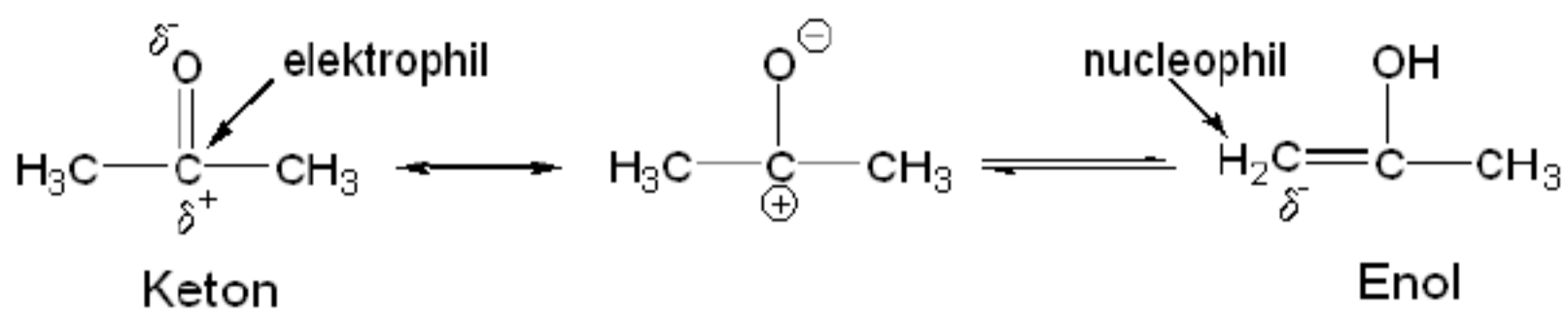


(Komplex aus Reagenz und Substrat, häufig geladen)

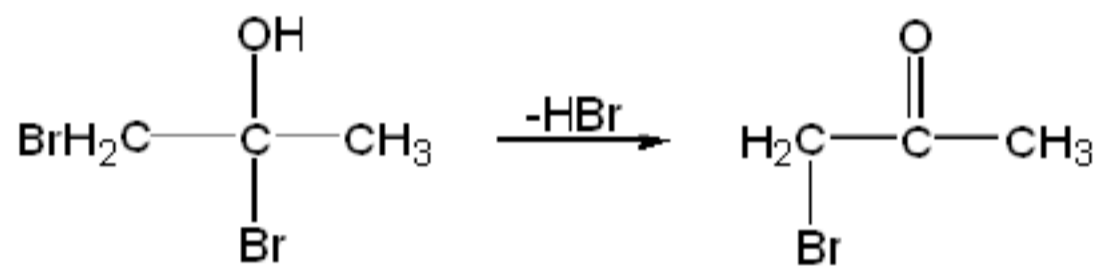


Keto-Enol Tautomerie

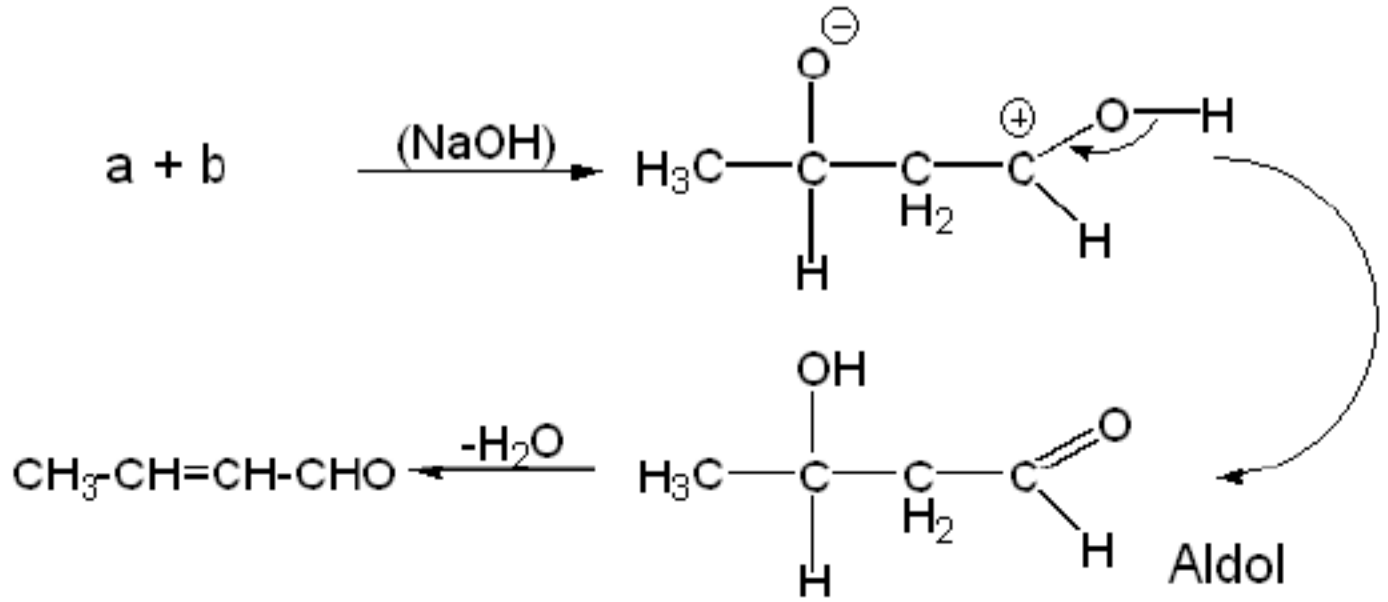
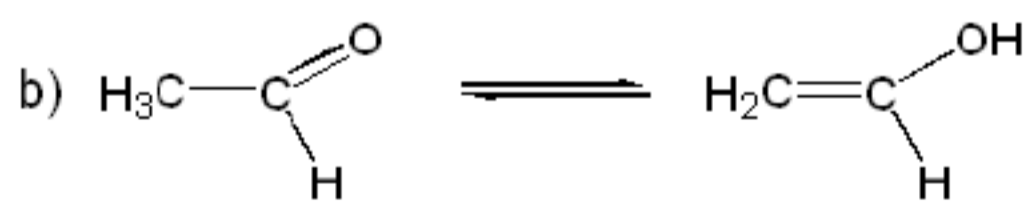
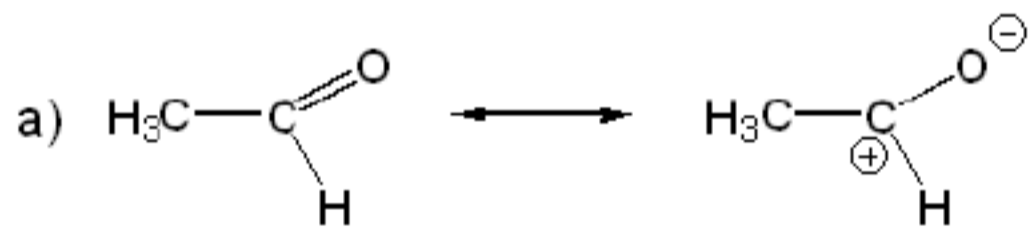
(Aldehyde, Ketone)



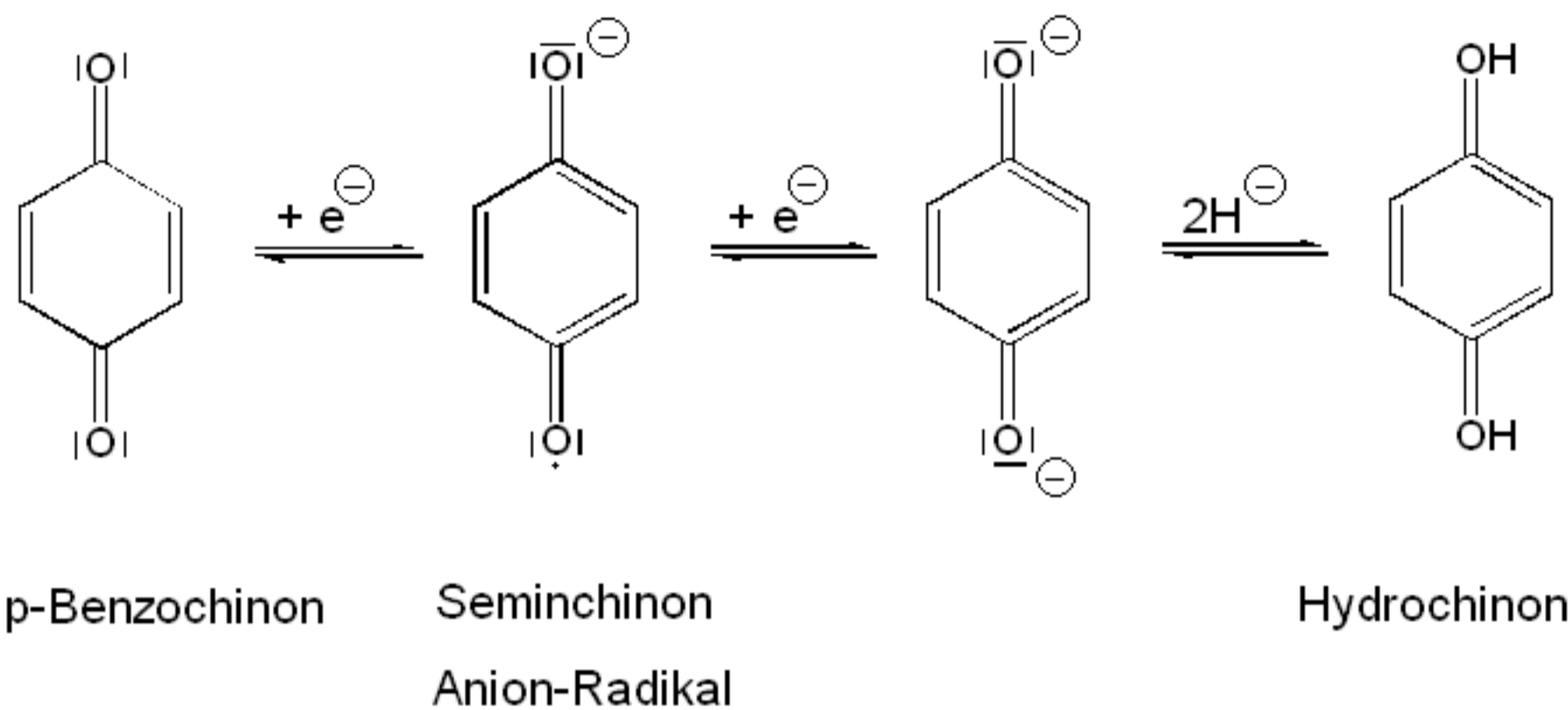
Eliminierung



Aldol-Kondensation



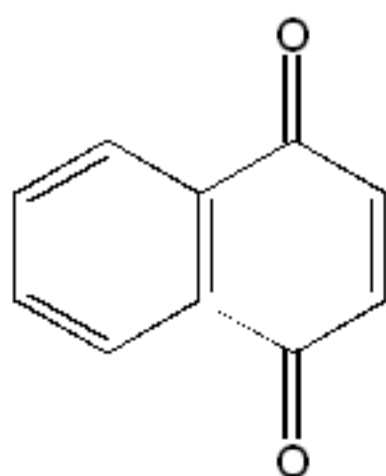
Chinone



reversibel

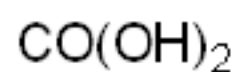
$$E = E_0 + \frac{RT}{2,3nF} \lg \frac{[\text{Chinon}] [\text{H}^+]^2}{[\text{Hydrochinon}]}$$

Potential ist pH-abhängig !



1,4-Naphthochinon

Carbonsäuren (mono)



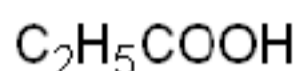
Kohlensäure (Carbonate)



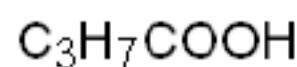
Ameisensäure (Formiate)



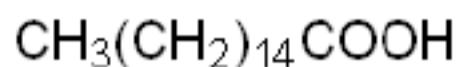
Essigsäure (Acetate)



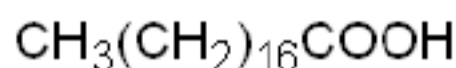
Propionsäure (Propionate)



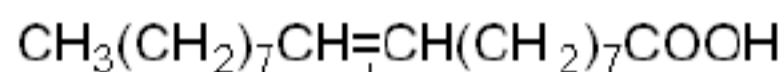
Buttersäure (Butylate)



Palmitinsäure (Palmiate)

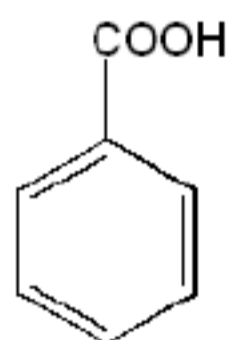


Stearinsäure (Stearate)

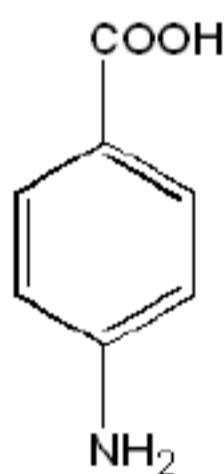


Ölsäure (Oleate)

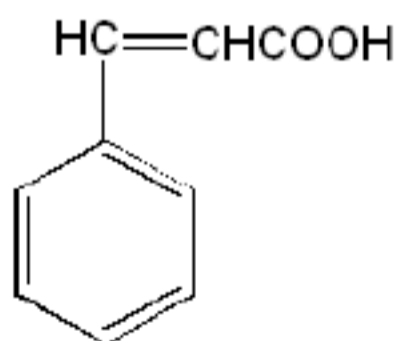
↑
(cis)



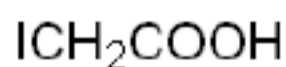
Benzoessäure (Benzoate)



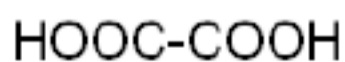
p-Aminobenzoessäure



trans-Zimtsäure (Cinnamate)



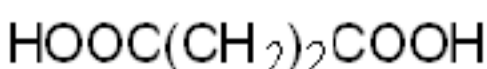
Iodessigsäure



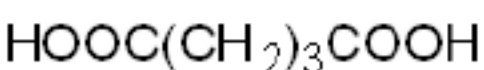
Oxalsäure (Oxalat)



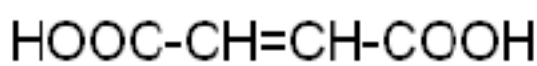
Malonsäure



Bernsteinsäure (Succinat)

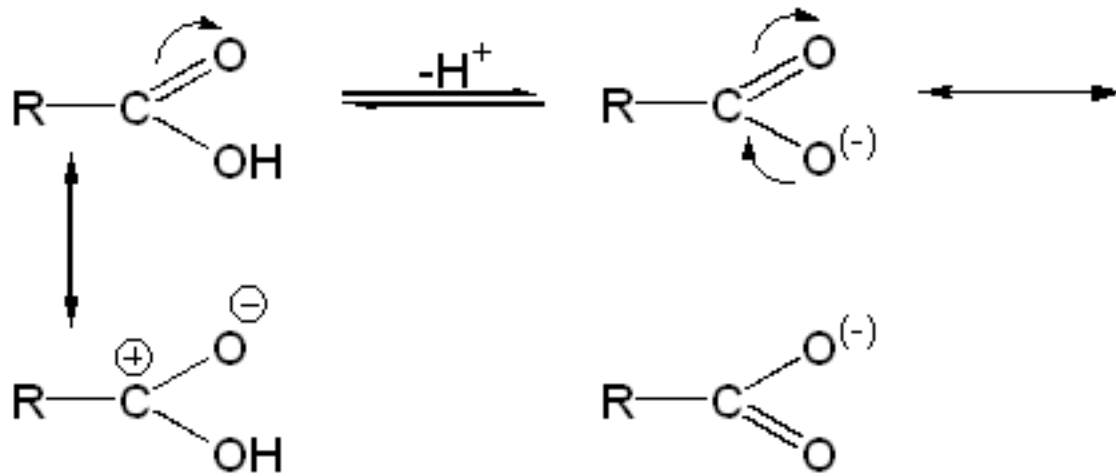


Glutarsäure



cis: Maleinsäure trans: Fumarsäure

Dissoziation



Je stärker elektronenziehend R,
desto niedriger ist der pK_s -Wert.

R = CH₃ pK_s = 4,8

CH₂J 3,9

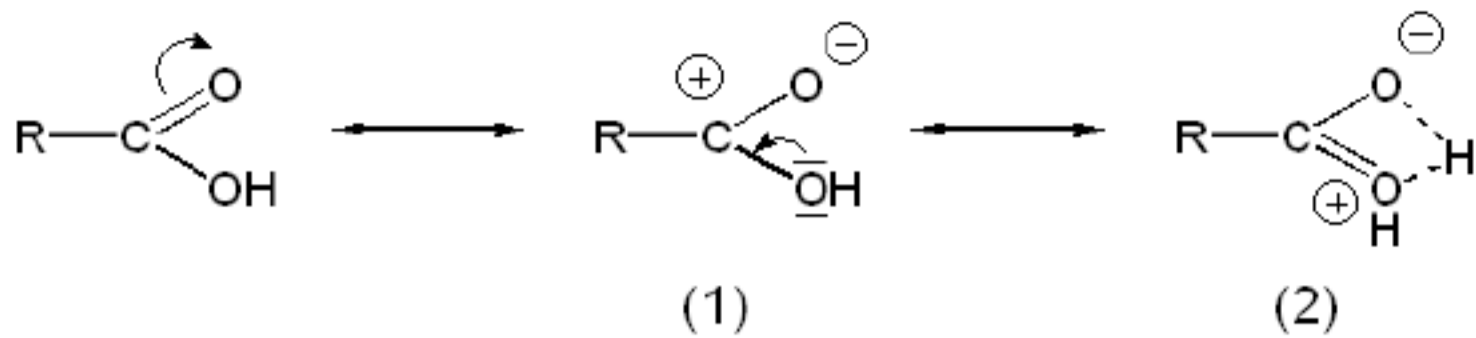
CF₃ 0,3

COOH 1,5

CH₂-N⁽⁺⁾H₃ 2,4

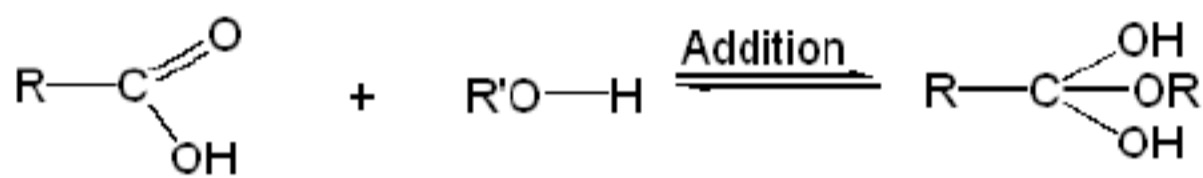
Reaktionen von Carbonsäuren

C ist weniger elektrophil als bei Ketonen und Aldehyden

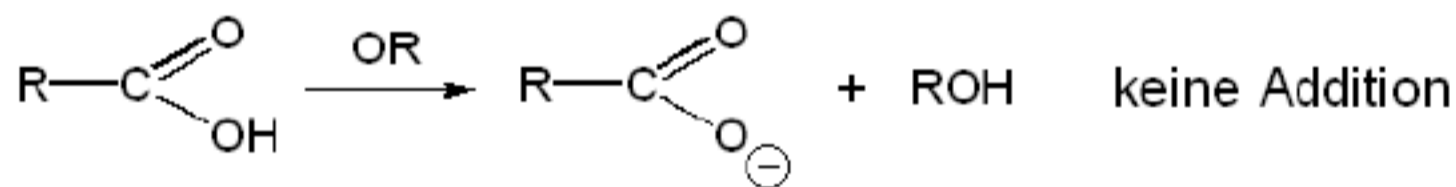
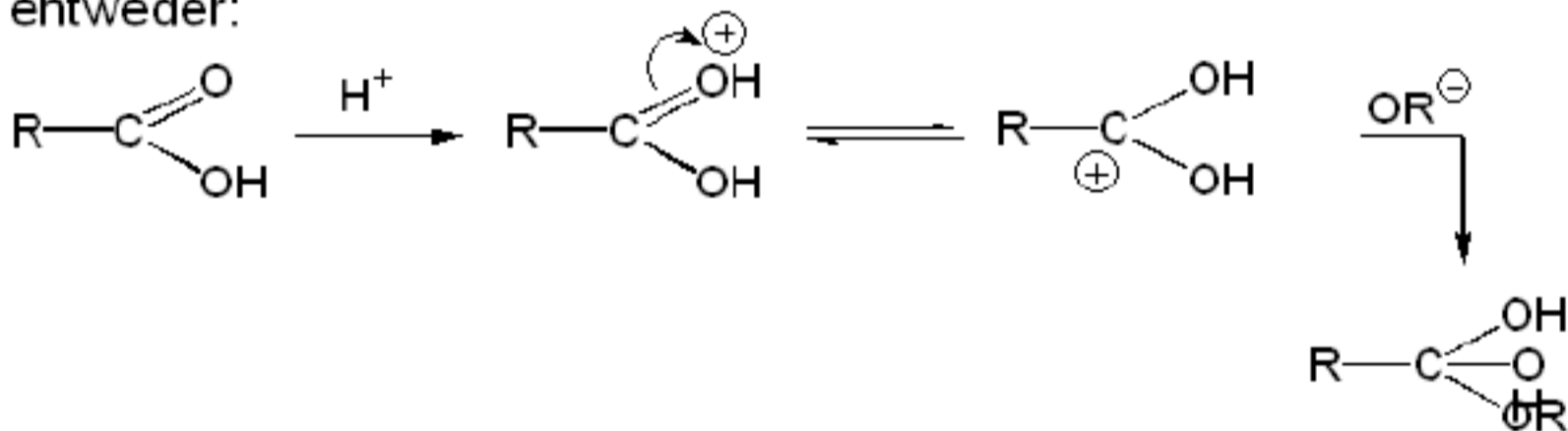


Reaktionstyp: Nucleophile Addition-Eliminierung

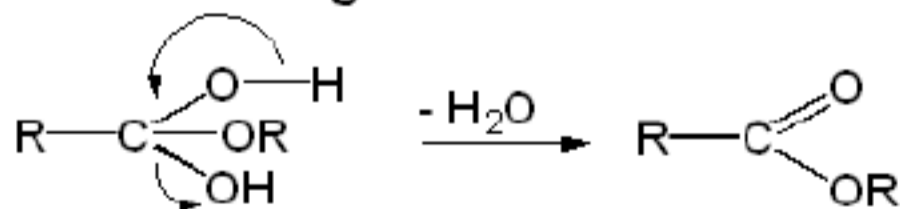
Addition



entweder:

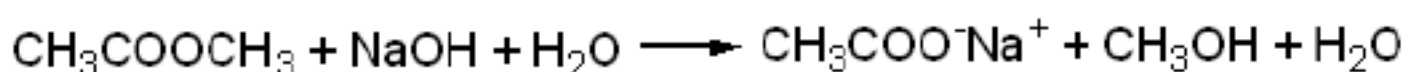
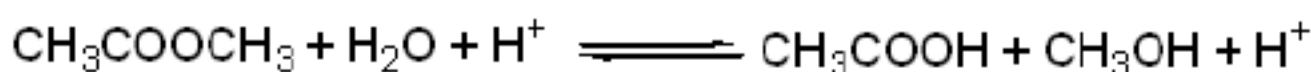


Eliminierung



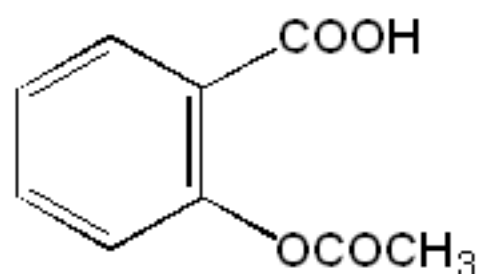
Die Umkehrung dieser "Veresterungsreaktion" heißt "Hydrolyse", oder im Falle der durch Alkali eingeleiteten Reaktion "Verseifung"

Säurekatalysierte Hydrolyse:

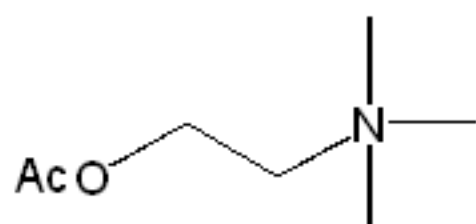


Ester

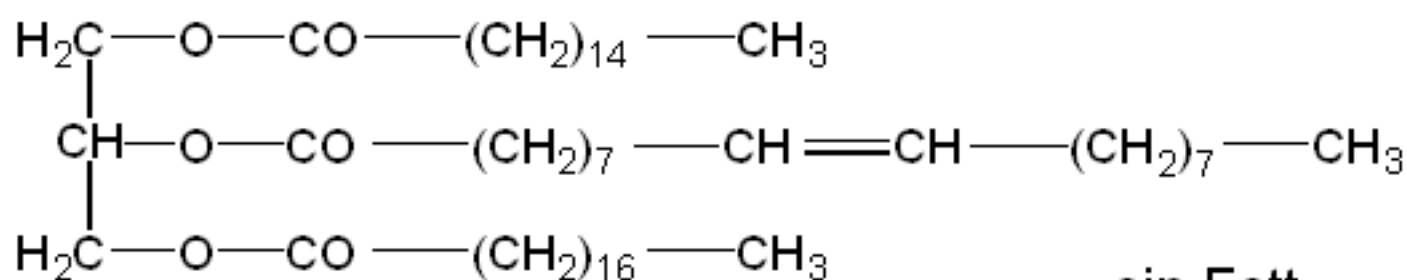
$\text{CH}_3\text{COOC}_2\text{H}_5$ Essigsäureethylester \equiv Ethylacetat



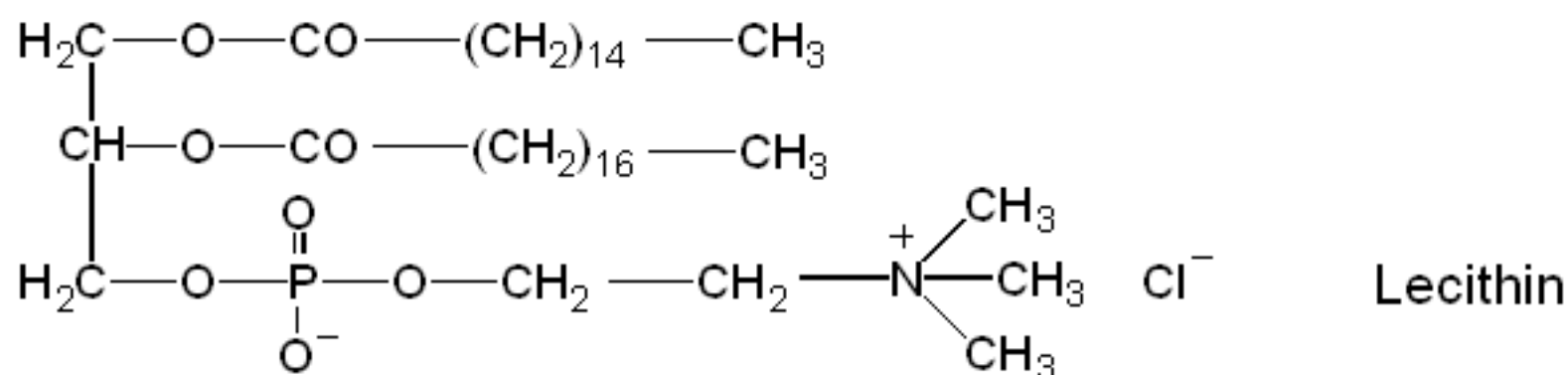
Acetyl-Salicylsäure
(Aspirin)



Acetyl-cholin $\text{Ac} = -\text{COCH}_3 = \text{Acetyl}$



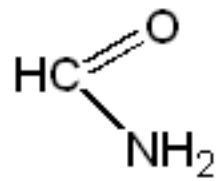
ein Fett
(Tri-ester)



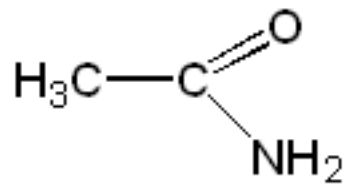
Lecithin

(P-säure-diester ; Zwitterion)

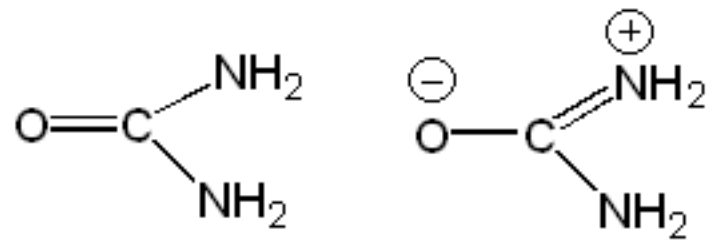
Amide



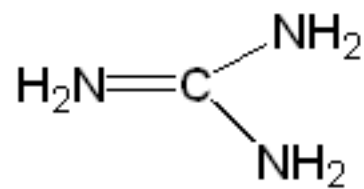
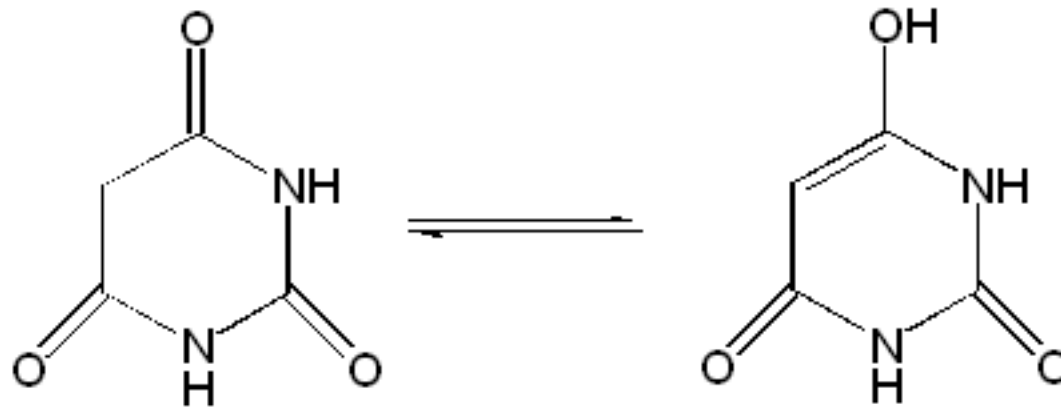
Formaldehyd



Acetamid



Harnstoff

Guanidin (pK_s = 13,4)

Barbitursäure

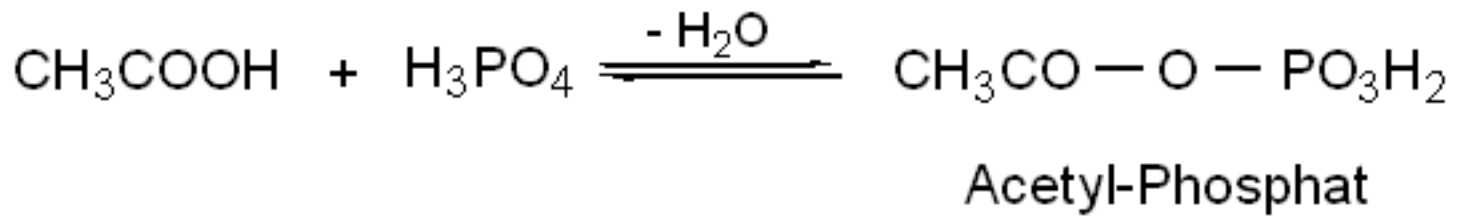
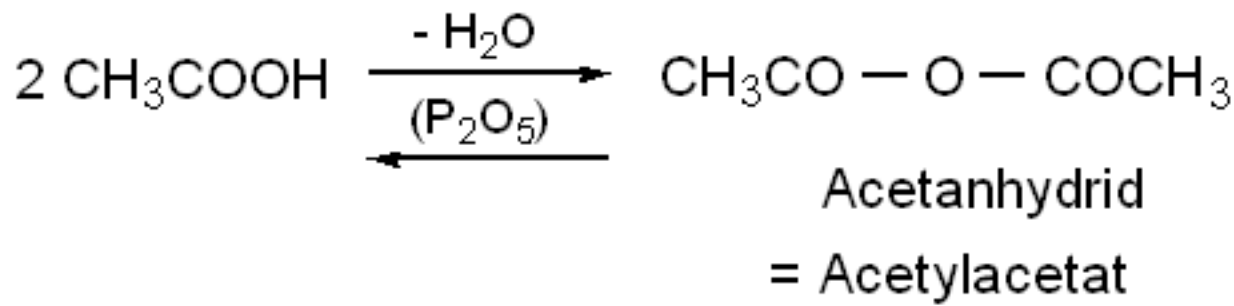
(Tautomerie)

Eigenschaften:

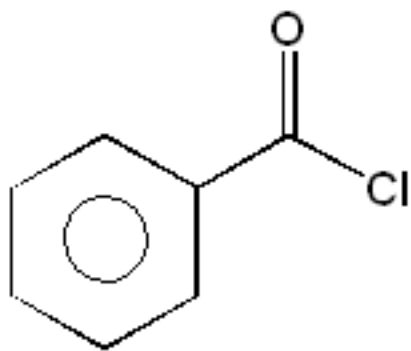
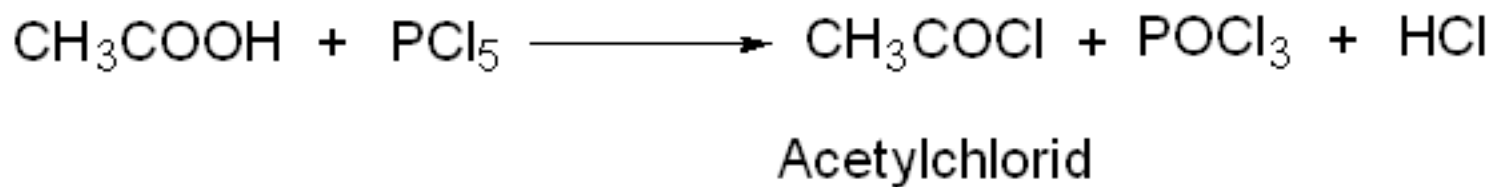


Amide sind nicht basisch (pK_s ~ 0,3) ; so sauer wie Alkohole

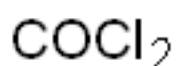
Anhydride



Chloride



Benzoylchlorid



Phosgen

Oxy- und Oxo-Derivate von Aldehyden, Ketonen und Carbonsäuren

3 C	$\text{CH}_3\text{-CHOH-COOH}$	Milchsäure (Lactat)
	$\text{CH}_3\text{-CO-COOH}$	Brenztraubensäure (Pyruvat)
	$\text{OHC-CHOH-CH}_2\text{OH}$	Glycerinaldehyd
	$\text{HOOC-CHOH-CH}_2\text{OH}$	Glycerinsäure

4 C	$\text{CH}_3\text{-CHOH-CH}_2\text{-COOH}$	3-Hydroxy-buttersäure
	$\text{CH}_3\text{-CO-CH}_2\text{-COOH}$	Acetessigsäure
	$\text{HOOC-CHOH-CH}_2\text{-COOH}$	Äpfelsäure
	$\text{HOOC-CO-CH}_2\text{-COOH}$	Oxal-Essigsäure
	$\text{HOOC-CHOH-CHOH-COOH}$	Weinsäure

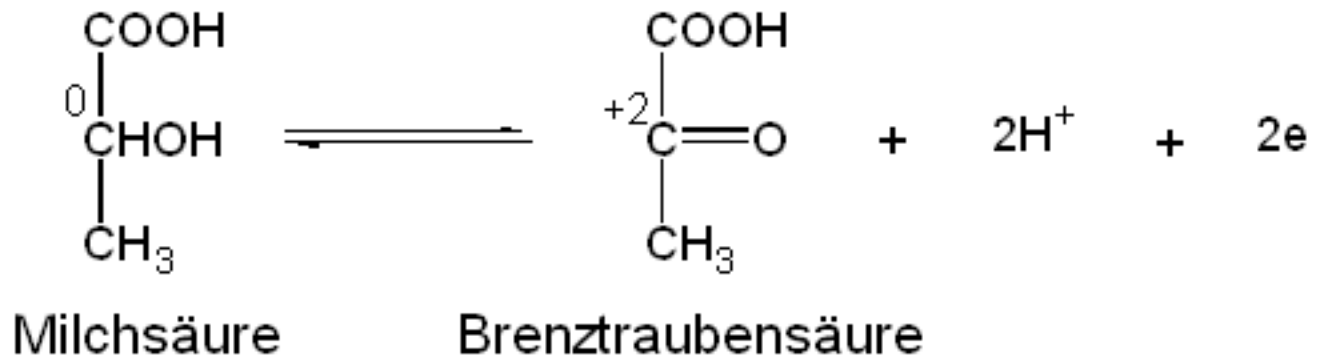
5 C	$\text{HOOC-CH}_2\text{-CH}_2\text{-CO-COOH}$	α -Ketoglutarsäure
-----	---	---------------------------

6 C	$\begin{array}{c} \text{OH} \\ \\ \text{HOOC-CH}_2\text{-C-CH}_2\text{-COOH} \\ \\ \text{COOH} \end{array}$	Citronensäure
-----	---	---------------

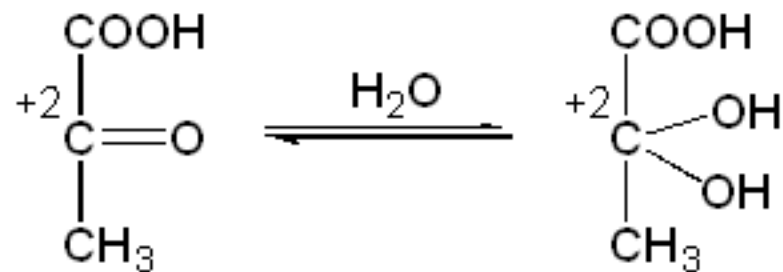
	$\begin{array}{c} \text{OH} \\ \\ \text{HOOC-CH}_2\text{-CH-CH-COOH} \\ \\ \text{COOH} \end{array}$	Iso-Citronensäure
--	---	-------------------

7 C		Salicylsäure
-----	---	--------------

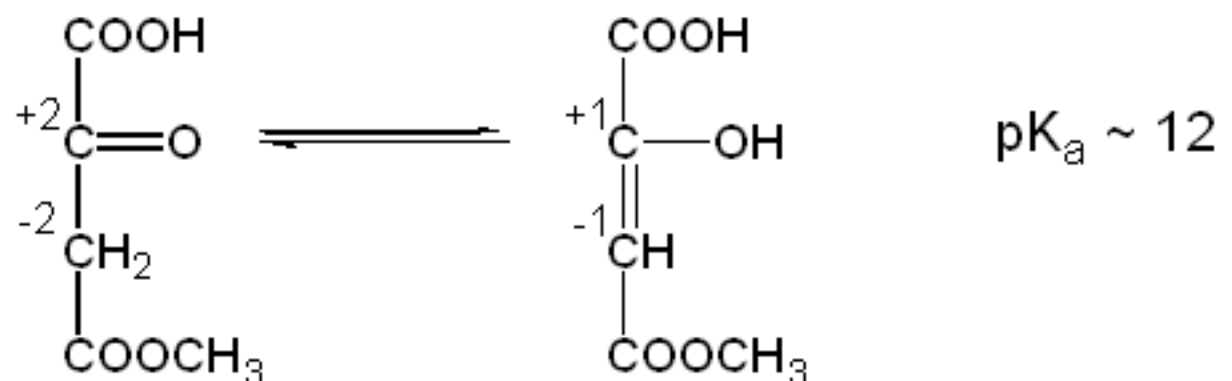
Redox-Reaktionen



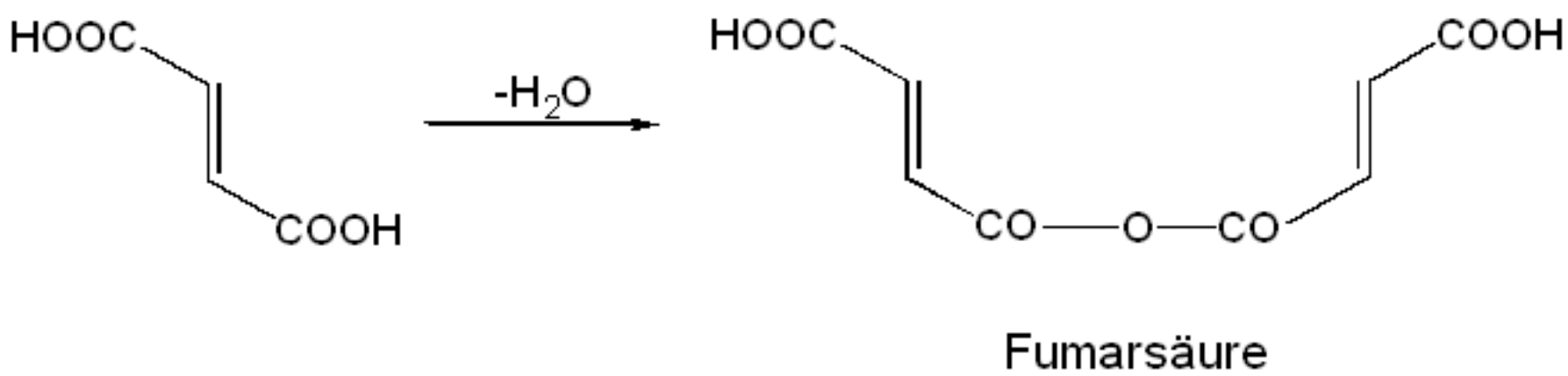
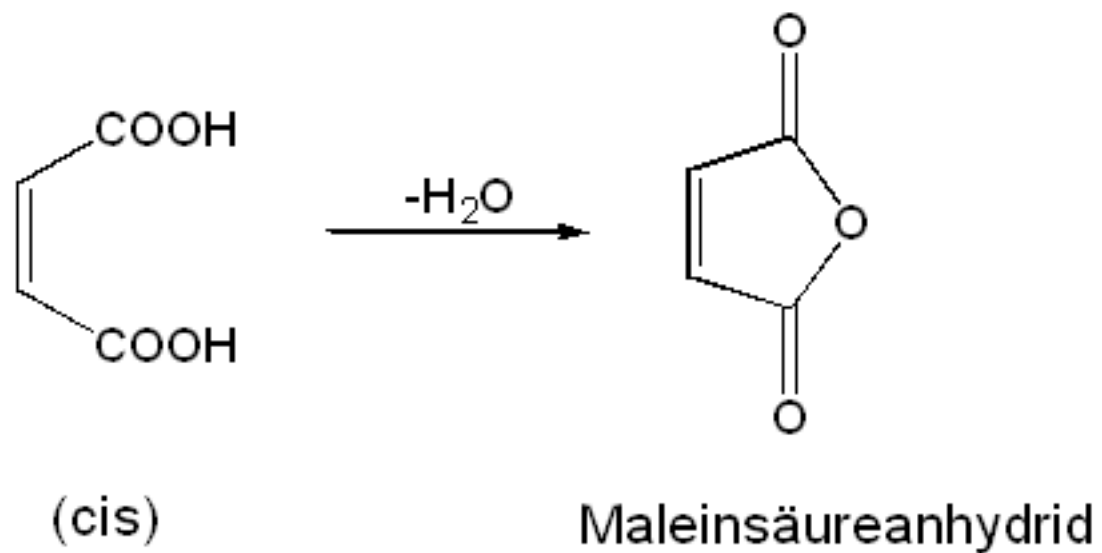
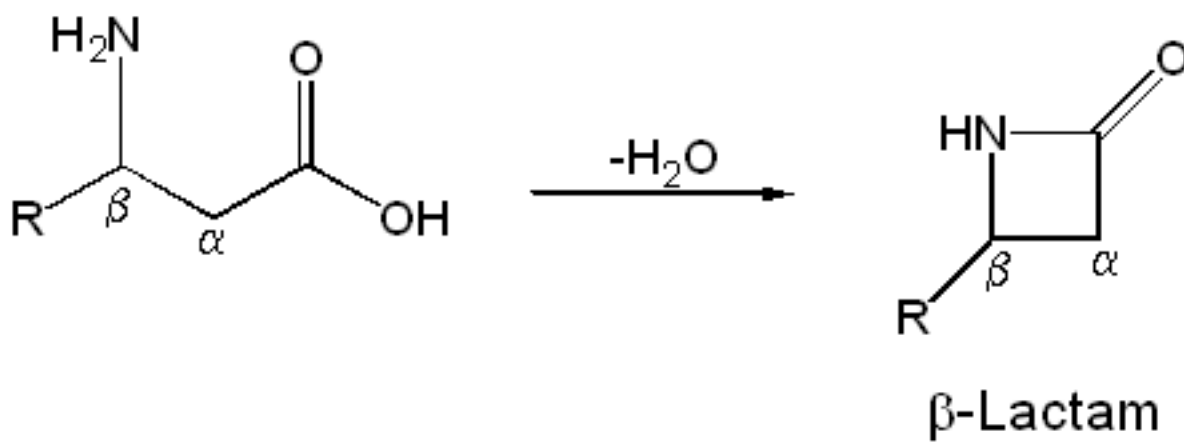
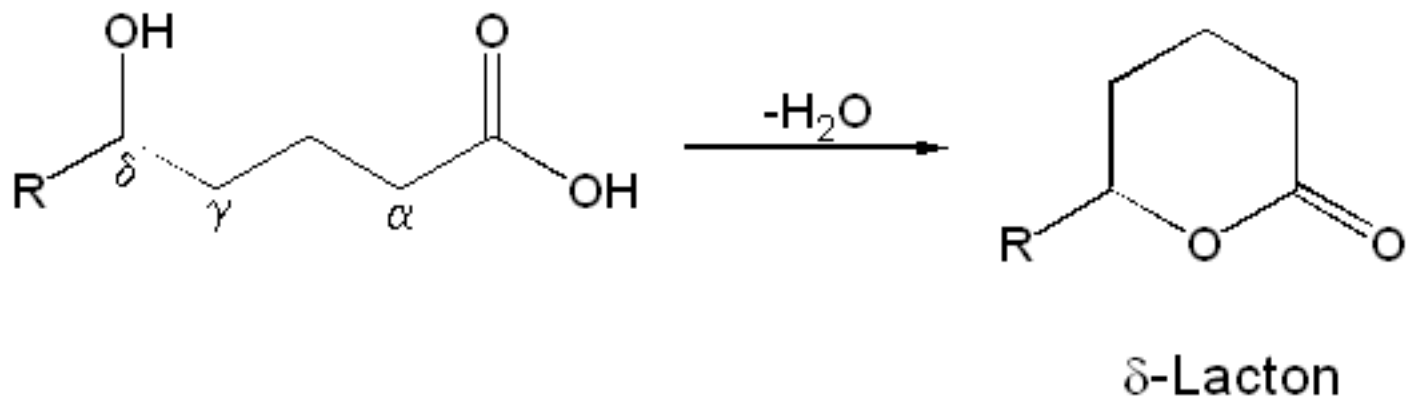
Hydratisierung



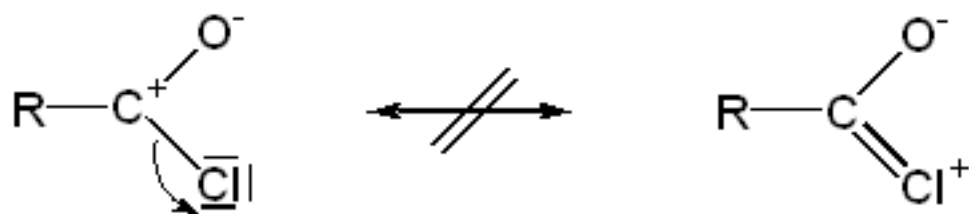
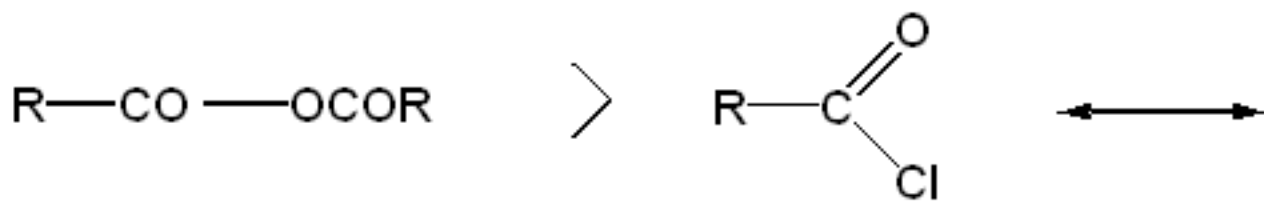
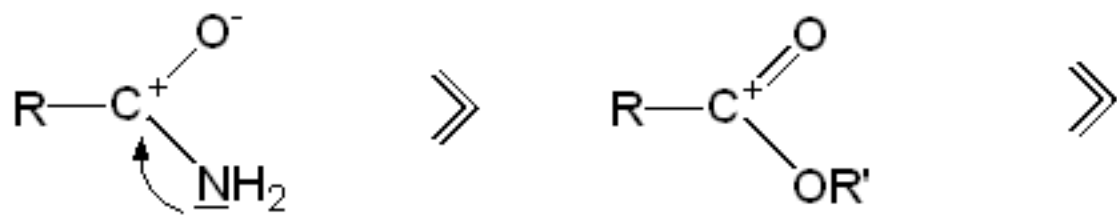
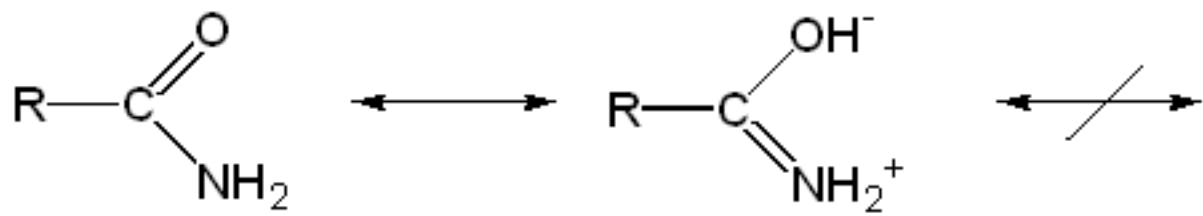
Enolisierung



cyclische Ester, Amide, Anhydride



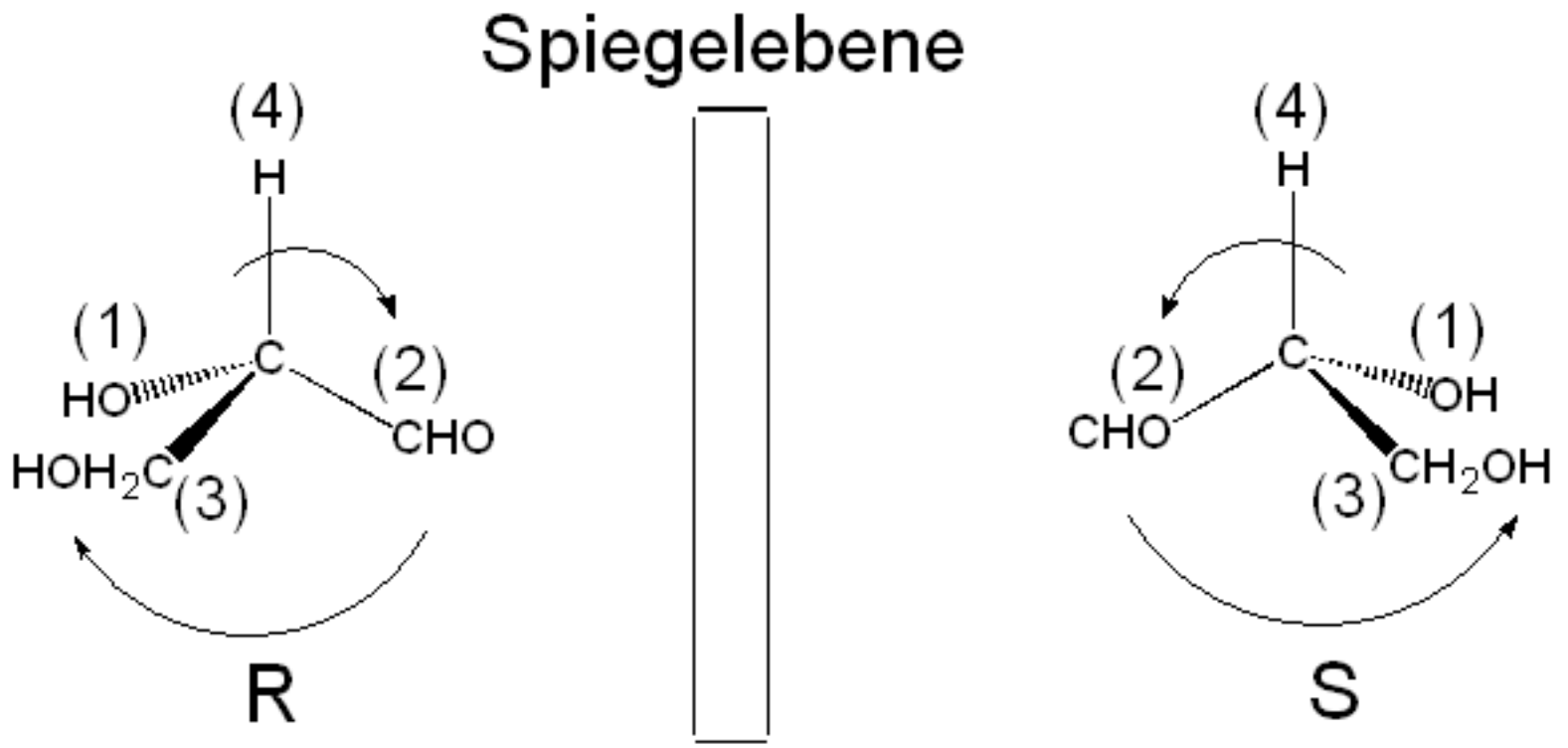
Stabilität gegen Hydrolyse



außerdem: Cl^- und RCOO^- gute "Abgangsgruppen"

(je "saurer" die konjugierte XH-Säure, desto leichter wird X^- abgespalten)

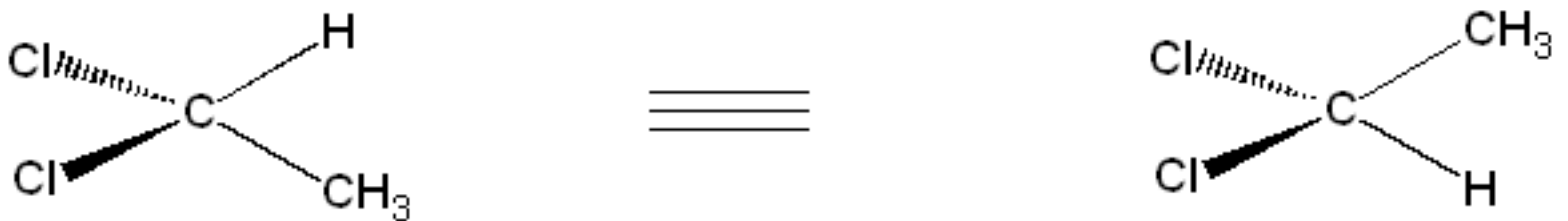
chirale Verbindungen



Enantiomere (enantio = entgegengesetzt)

Kohlenstoffatome mit zwei gleichen Substituenten sind achiral

Beispiel: CH_3CHCl_2



Racemate: 1:1 Mischungen zweier Enantiomerer

Prioritäten

1. **Atome:** J, Br, Cl, S, P, F, O, N, C, H 

abnehmende Atomgewichte

abnehmende Prioritäten

2. **C-Gruppen:** $-\text{C}(\text{CH}_3)_3$, $-\text{CH}(\text{CH}_3)_2$,

$-\text{CH}_2\text{-CH}_3$, $-\text{CH}_3$, $-\text{C}\equiv\text{N}$, $-\text{C}_6\text{H}_5$, $-\text{C}\equiv\text{CH}$

$-\text{CH}=\text{CH}_2$, COOH , $-\text{CONH}_2$, $-\text{COCH}_3$

$-\text{COOCH}_3$

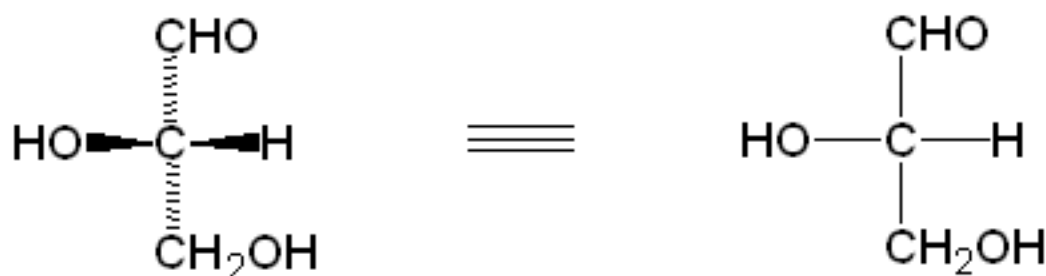
$-\text{CH}_3 < -\text{CH}_2\text{OH} < -\text{CHOH} < -\text{CHO} < -\text{COO}^-$

abnehmende Prioritäten (nach den Atomen am C)
danach nach den weiteren gebundenen Atomen

Cahn-Ingold-Prelog

Fischer Projektion

1. Längste C-Kette von oben nach unten
Das obere Ende trägt das Kohlenstoffatom höherer Oxidationszahl
2. Substituenten oben und unten werden alle nach unten gelegt (unterhalb der Papierebene)
3. Substituenten rechts und links ragen alle nach oben (oberhalb der Papierebene)
4. Alle Substituenten werden in die (Papier-) Ebene projiziert



L-konfiguriert

S-konfiguriert

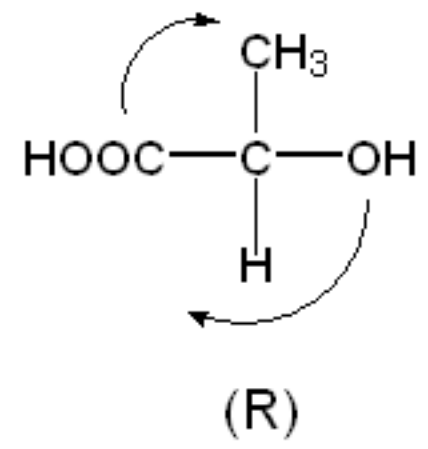
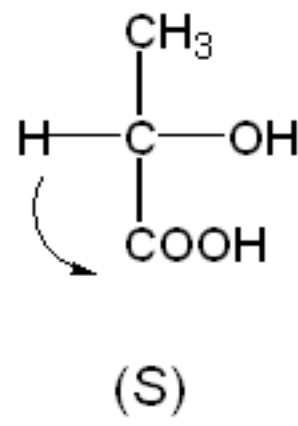
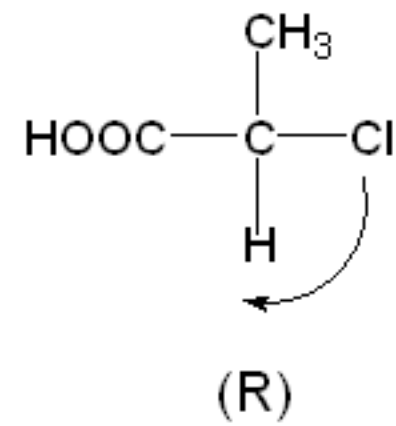
Fischer

Cahn-Ingold-Prelog

Zuordnung R, S aus der Fischer Projektion

1. H nach unten tauschen
2. bei einmaligem Tausch: Konfigurationsumkehr
3. bei zweimaligem Tausch: Konfigurationserhaltung

Beispiele:



Zuordnung in Stereoformeln

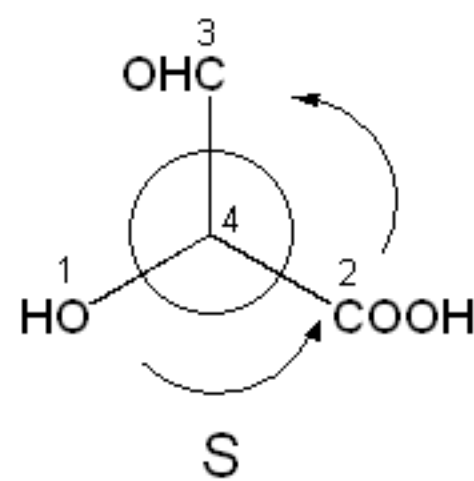
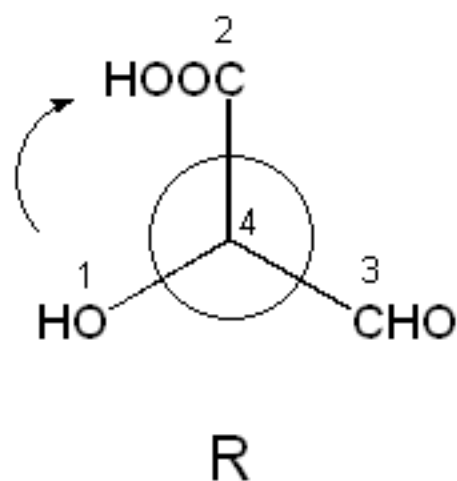
1. Substituent niedrigster Priorität nach hinten (meist H)

2. Prioritätsabfolge im Uhrzeigersinn:

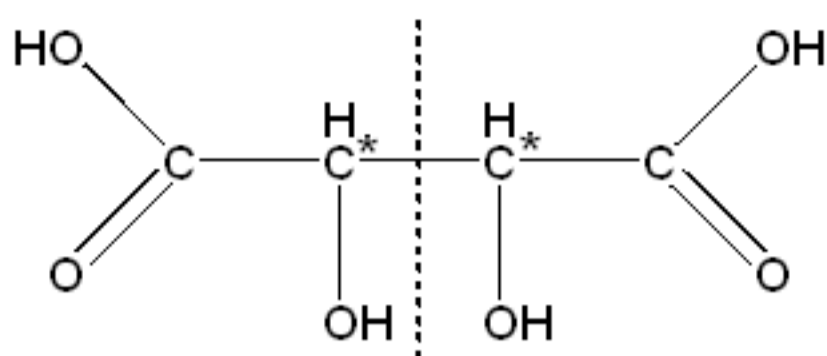
R (= D)

entgegen dem Uhrzeigersinn:

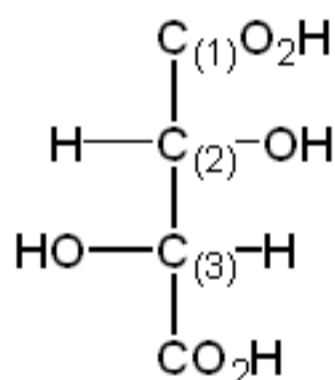
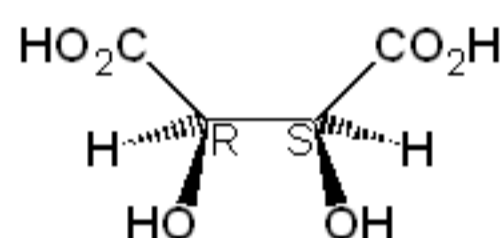
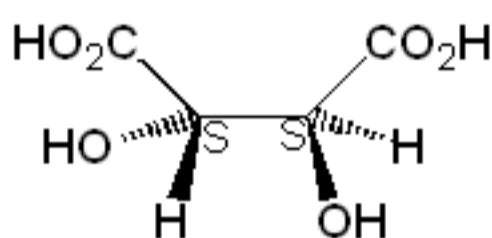
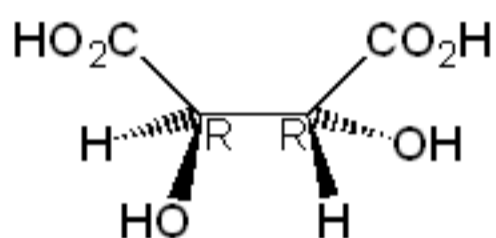
S (= L)



Diastereomere

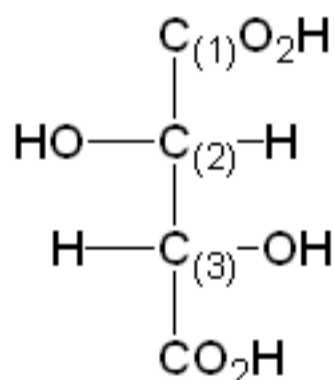


Weinsäure



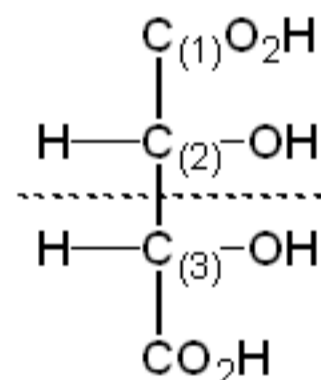
L-Weinsäure

(2R,3R)-Weinsäure



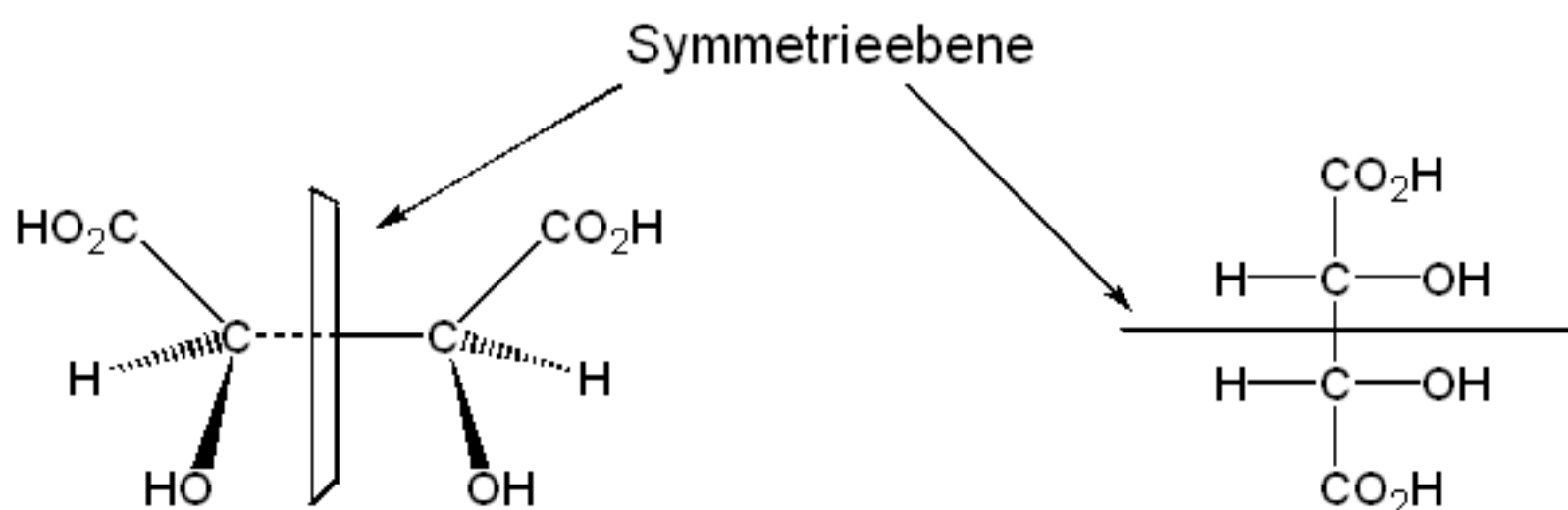
D-Weinsäure

(2S,3S)-Weinsäure

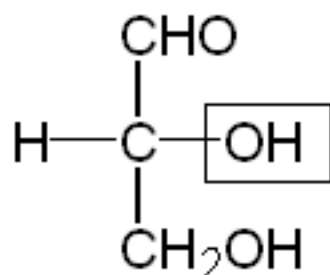
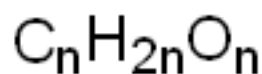


Meso-Weinsäure

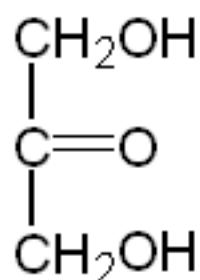
(2R,3S)-Weinsäure



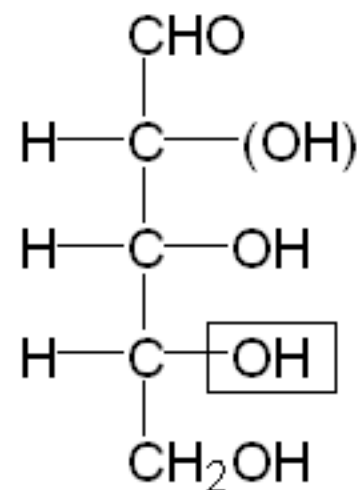
Kohlenhydrate



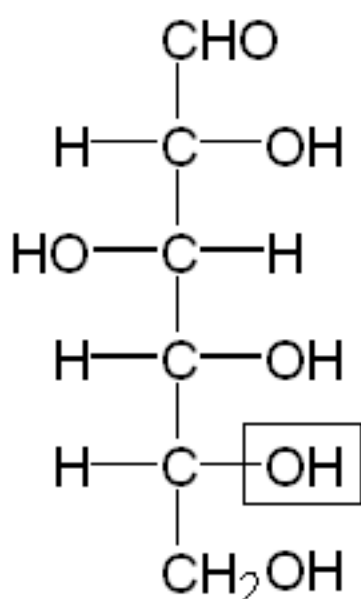
R (D)-
Glycerinaldehyd
(Aldo)



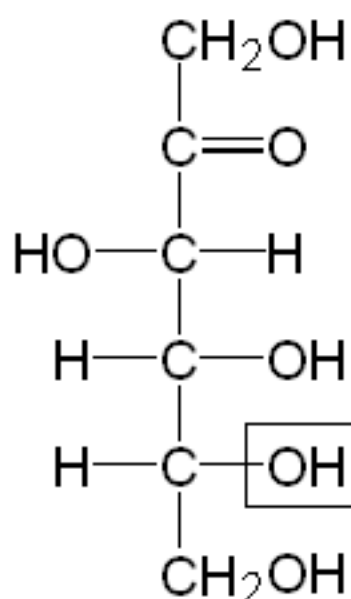
Dihydroxyaceton
Triosen (Keto)



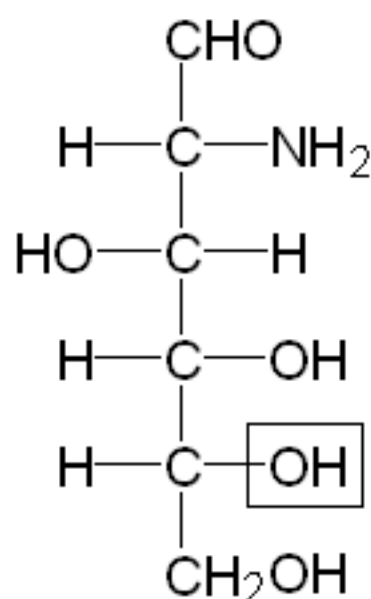
R (D)-
(Desoxy) Ribose
(Aldo) Pentose



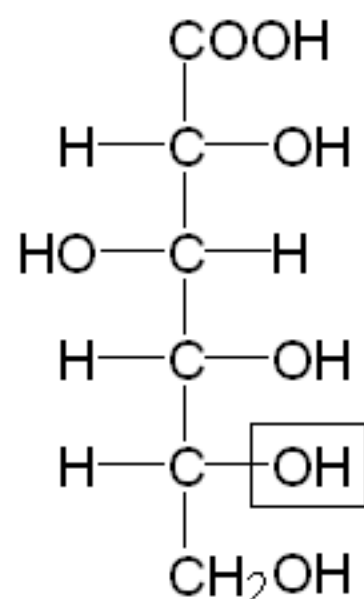
R (D)-Glucose



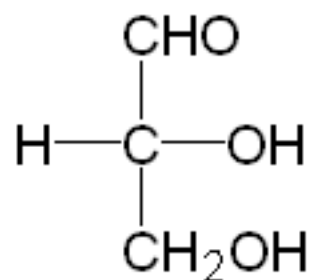
R (D)-Fructose



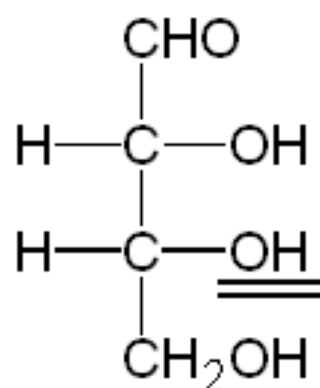
R-Glucosamin



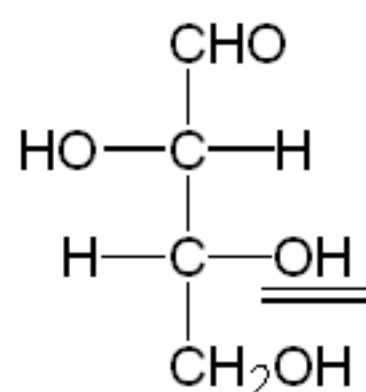
Gluconsäure



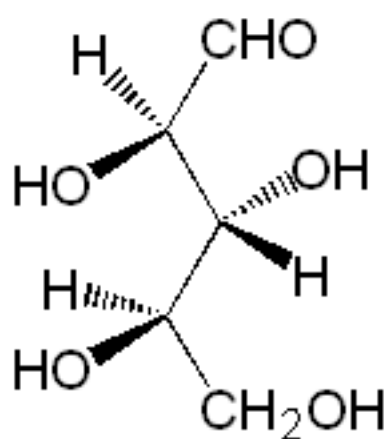
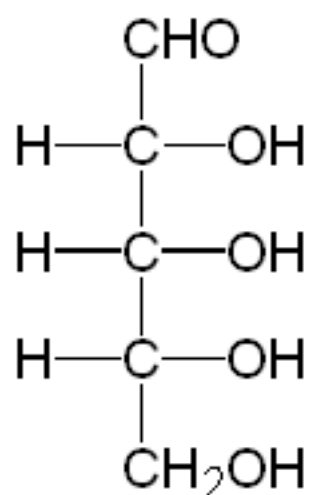
D-Glyceralinaldehyd
(=R)



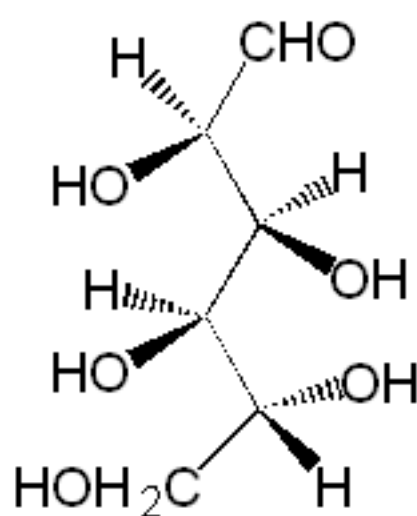
D-Erythrose
(=R)



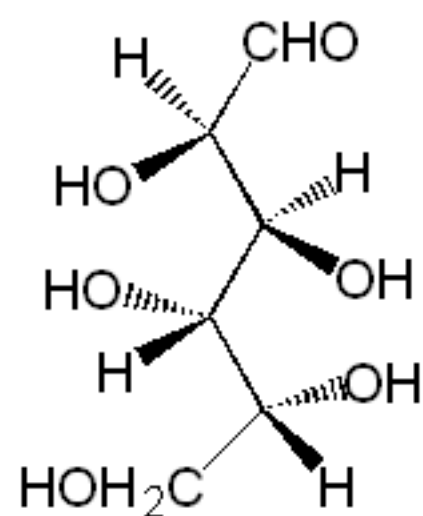
D-Threose
(=R)



R-Ribose



R-Glucose



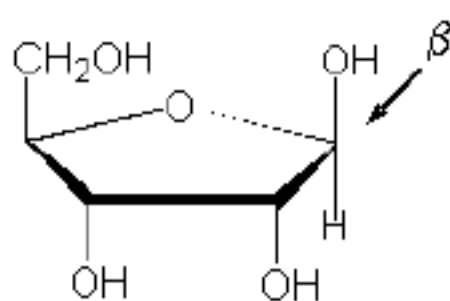
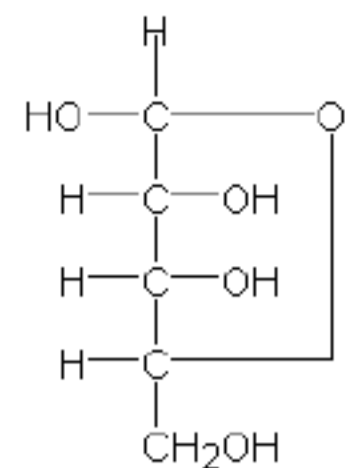
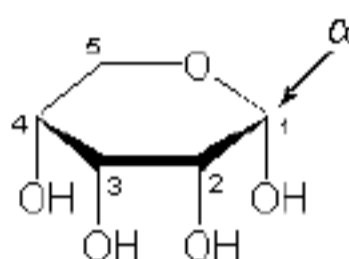
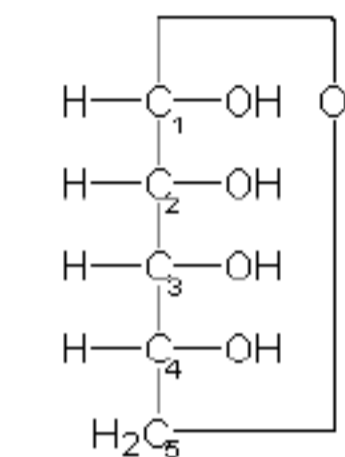
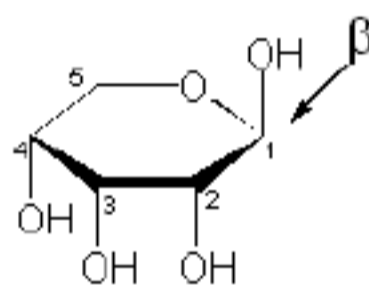
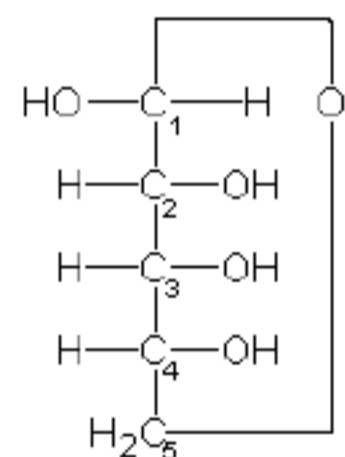
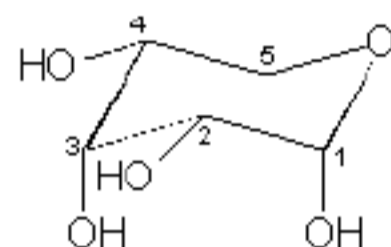
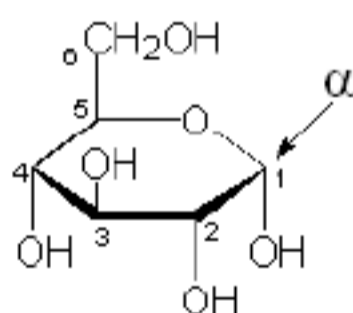
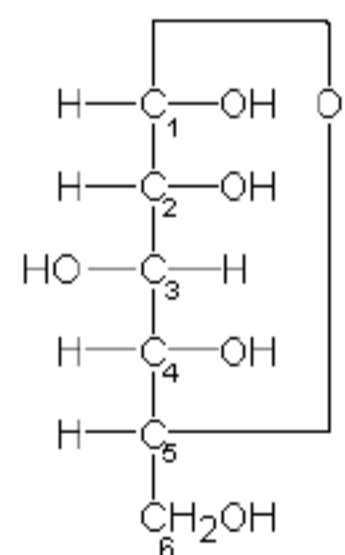
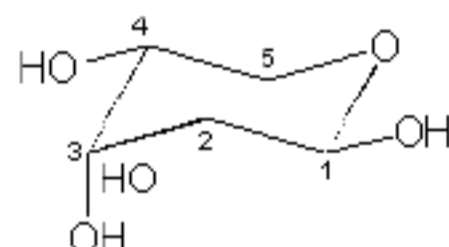
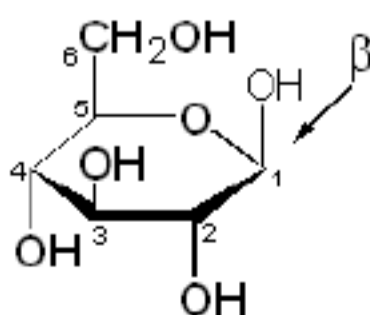
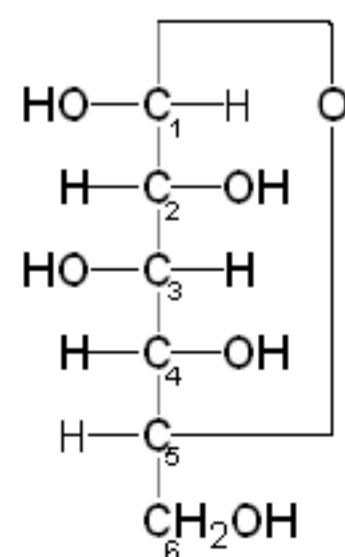
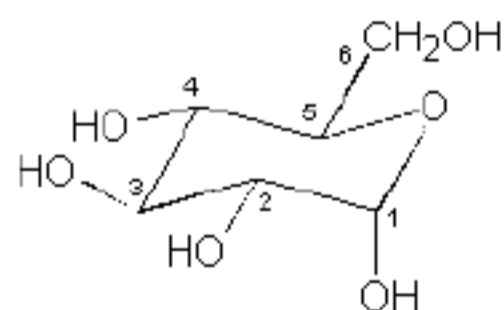
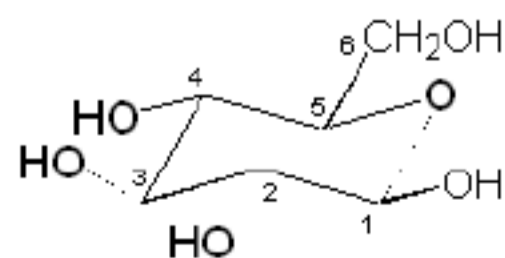
R-Galactose

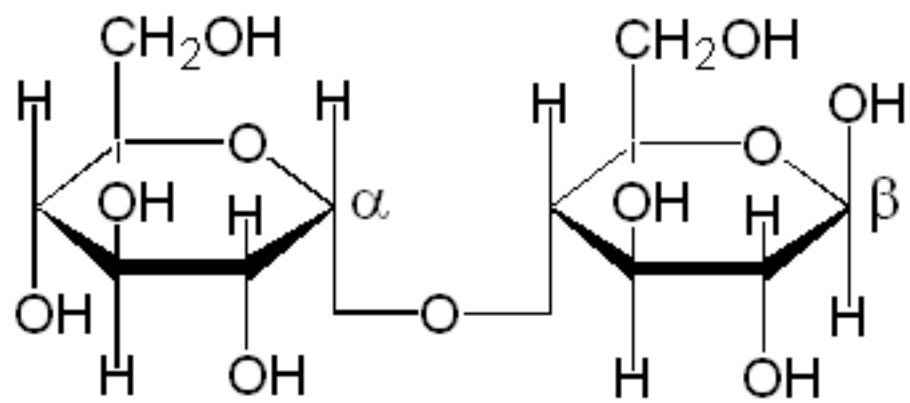
Fischer Projektion

Haworth Projektion

Sesselform

(siehe Fischer Konformation)

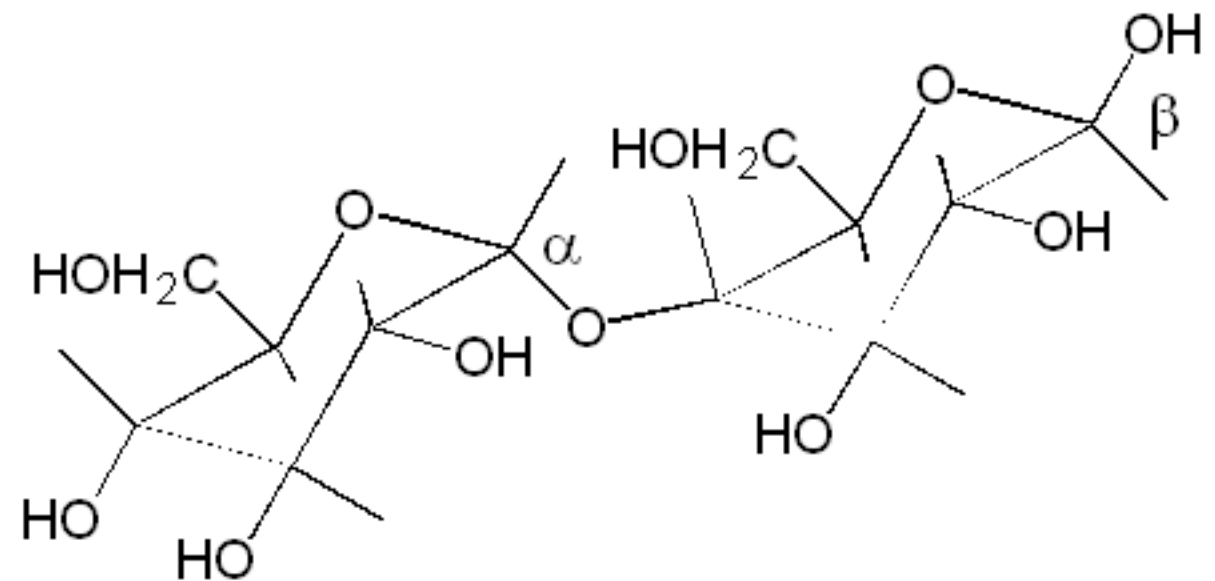
 β -R-Ribofuranose α -R-Ribopyranose β -R-Ribopyranose α -R-Glucopyranose β -R-Glucopyranose



α -Glycosid

Maltose (β -Form)

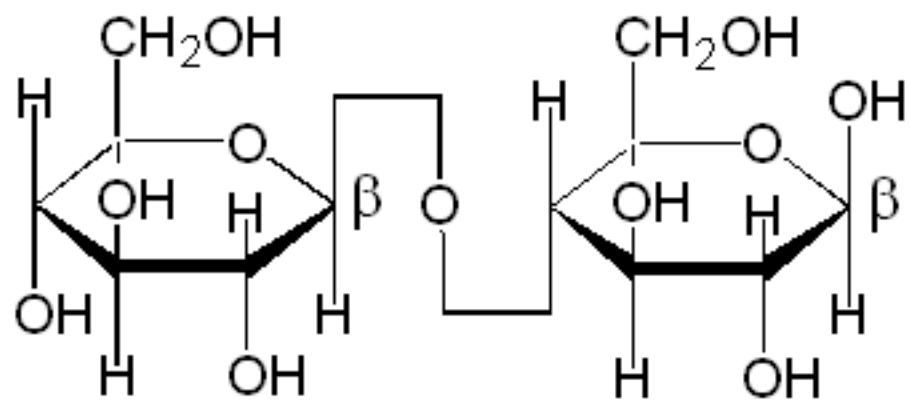
(Fehling +)



α -D-Glucose-
baustein

β -D-Glucose-
baustein

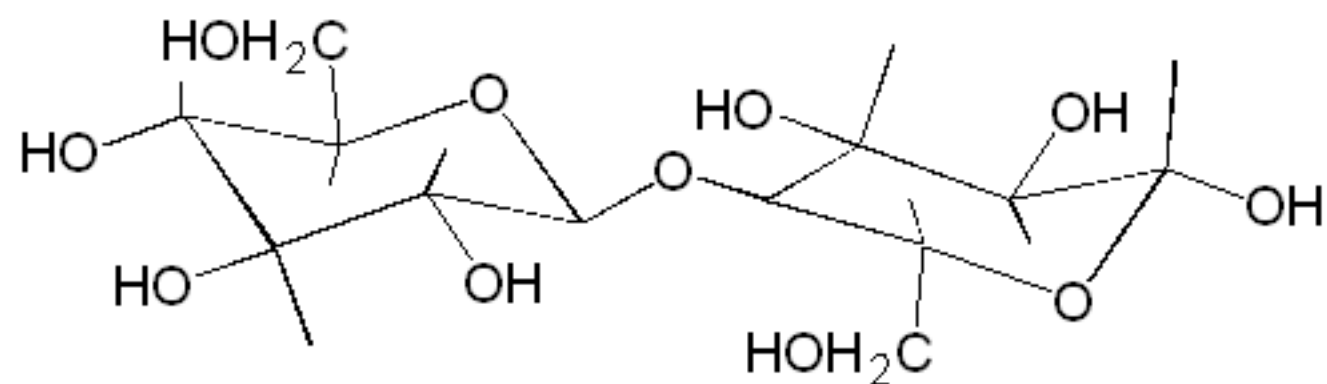
Stärke (Fehling -)



β -Glycosid

Cellobiose (β -Form)

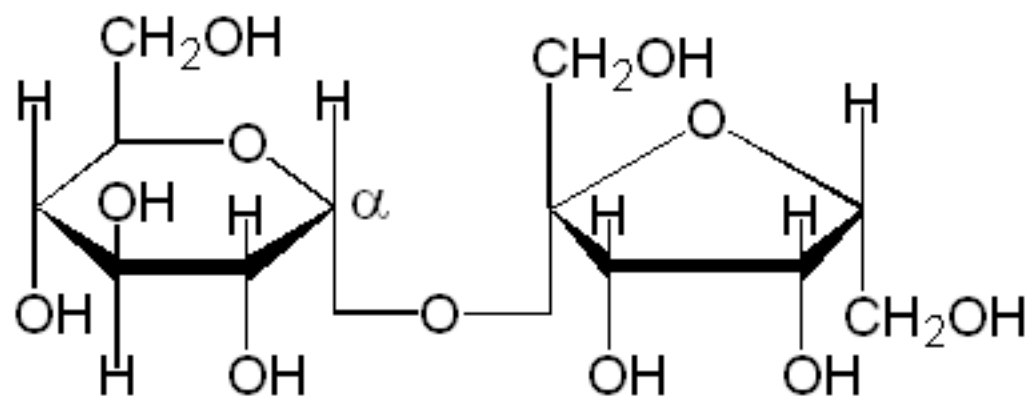
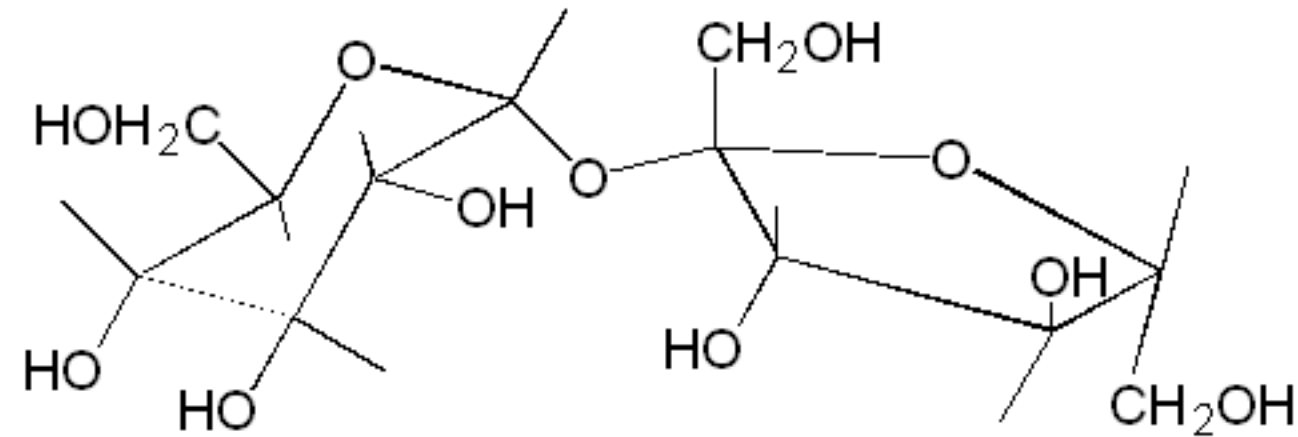
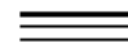
(Fehling +)



β -D-Glucose-
baustein

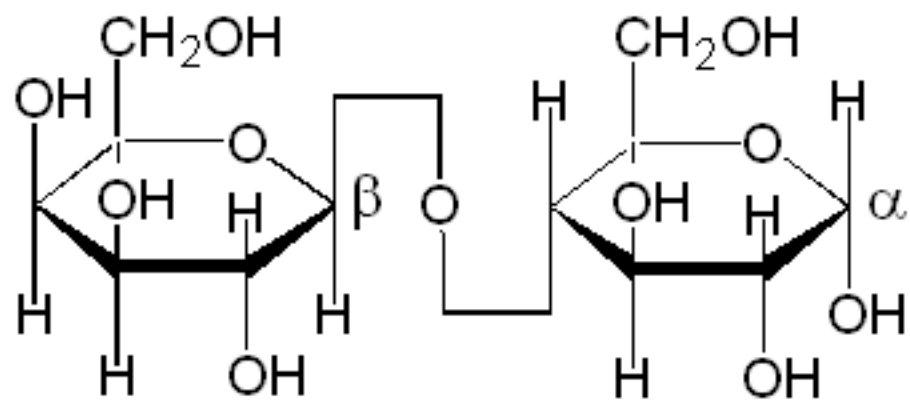
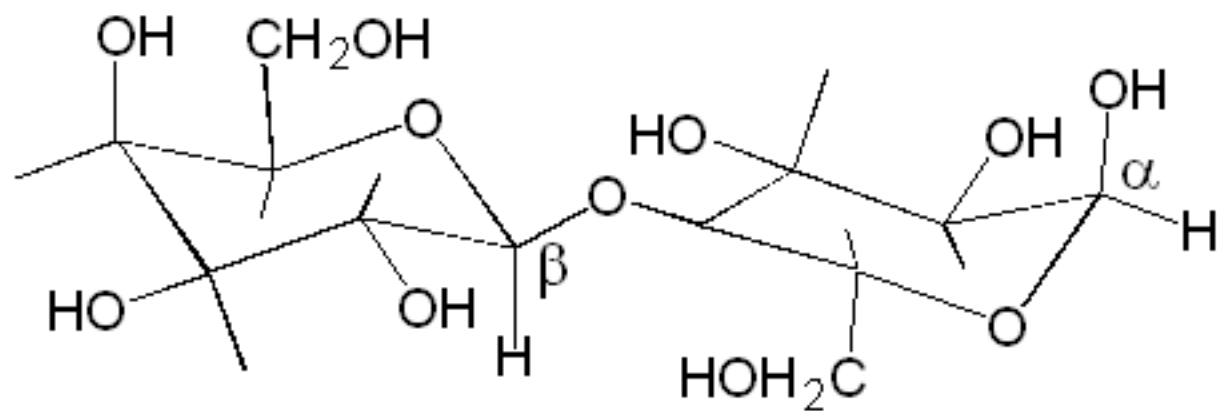
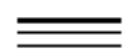
β -D-Glucose-
baustein

Cellulose (Fehling -)

 α -Glycosid α -D-Glucose-
baustein β -D-Fructose-
baustein

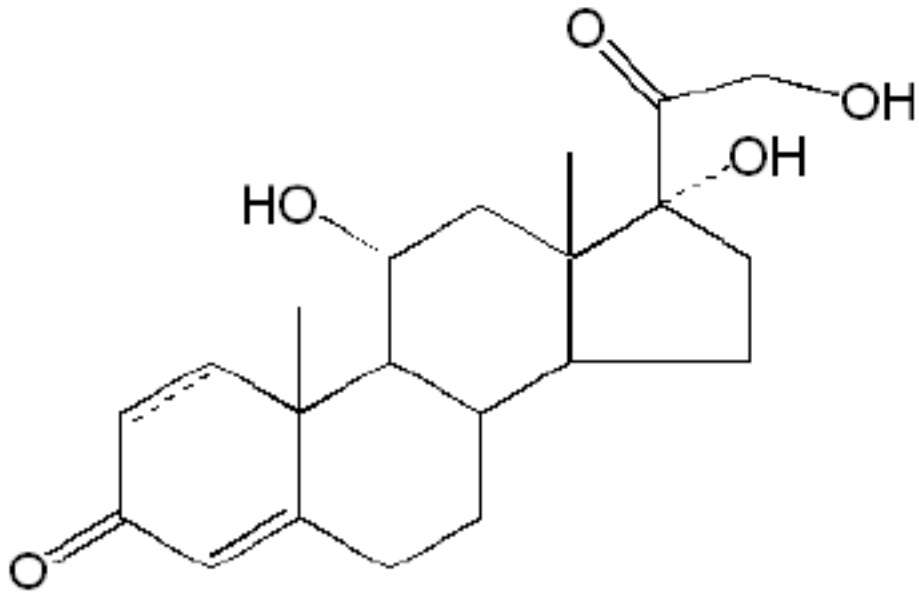
Rohrzucker (Saccharose)

(Fehling -)

 β -Glycosid β -D-Galactose-
baustein α -D-Glucose-
baustein

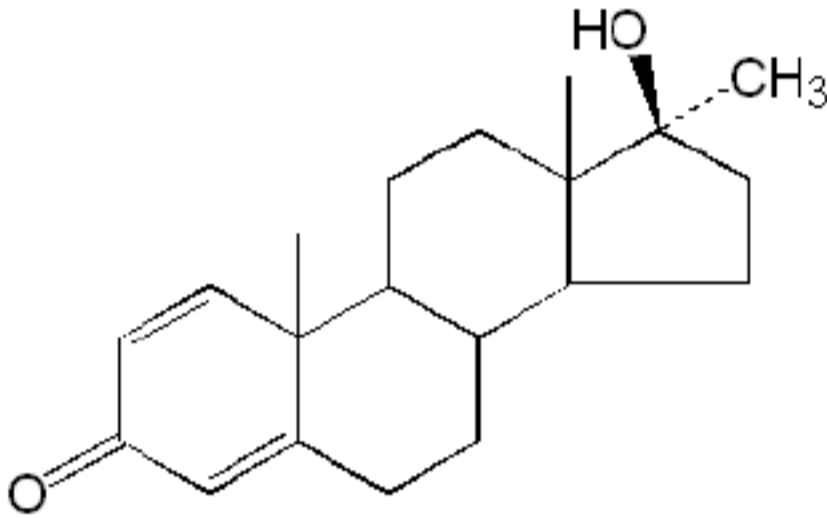
Lactose (β -Form)

(Fehling +)



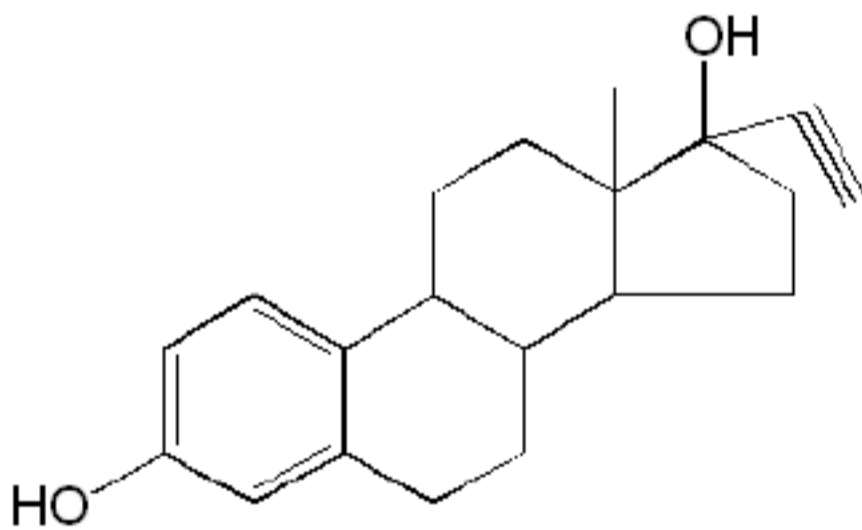
Hydrocortison

(Mineralstoffwechsel,
... Katabolikum)



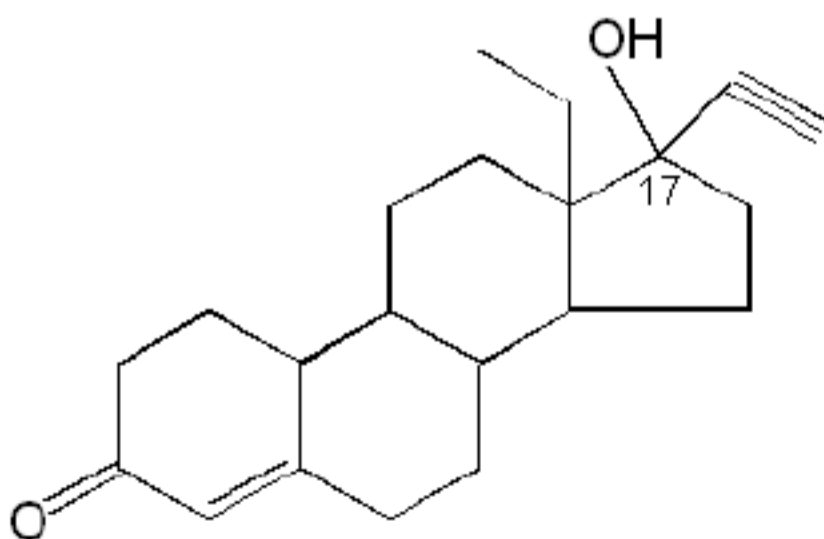
Dianabol

(Anabolikum)



Ethinylöstradiol

(Östrogen)



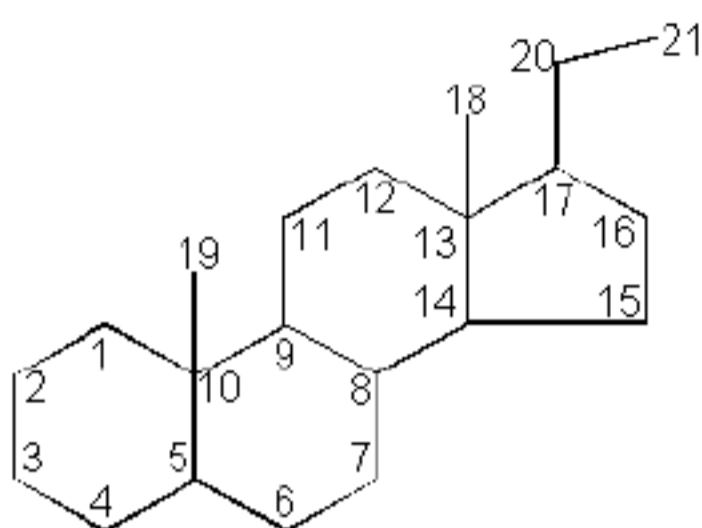
Norgestrel

(Gestagen)

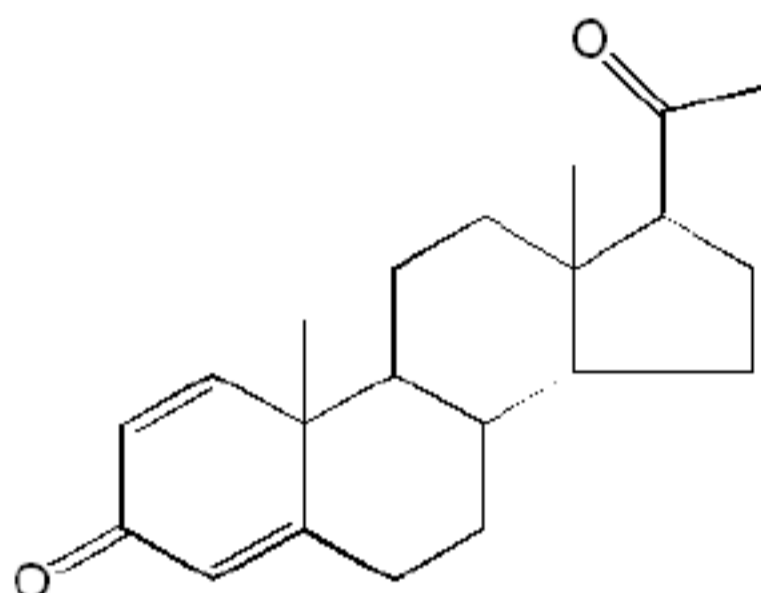
**Steroid-Hormone, keine oder kurze
Seitenkette in C-17**

Locasalen, Flumethasone

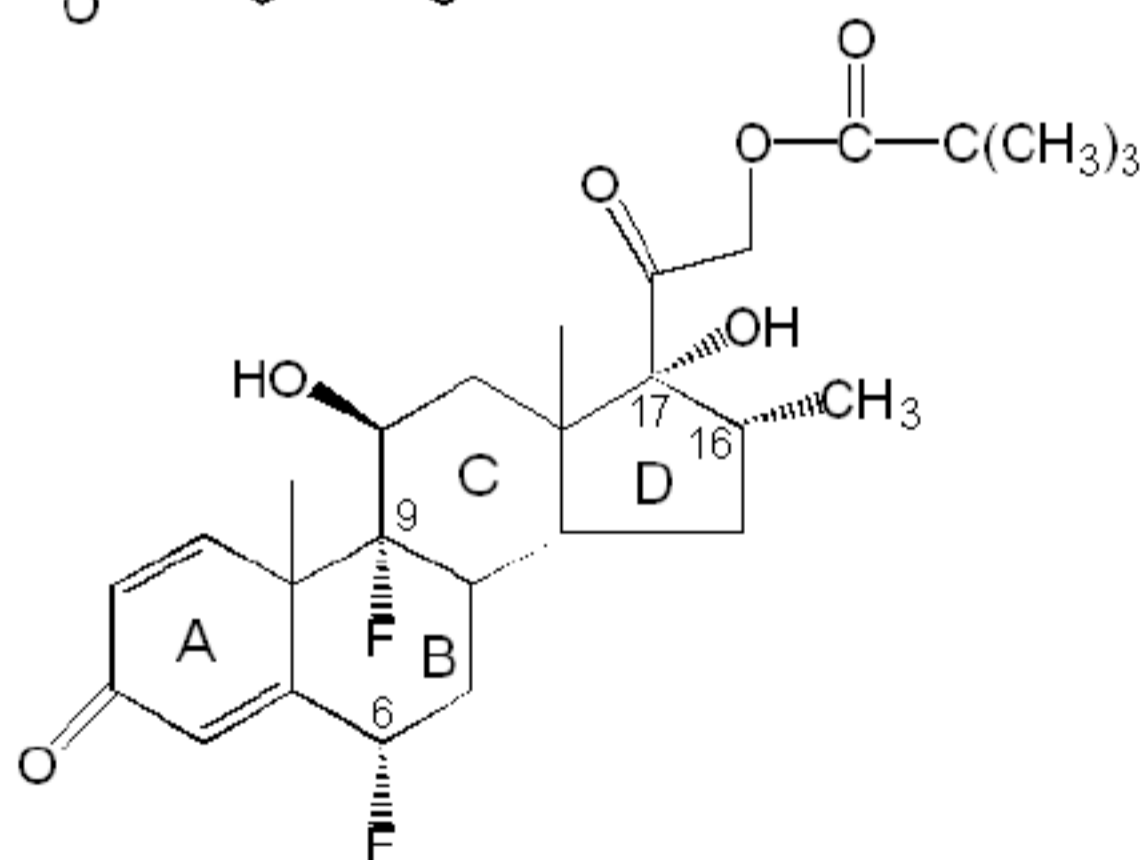
6 α , 9 α -Difluor-11 β , 17 α -dihydroxy-16 α -methyl-21-trimethyl-acetoxy-1,4-pregnadien-3,20-dion



Pregnan



The Merck Index
1,4-pregnadien-3,20-dion



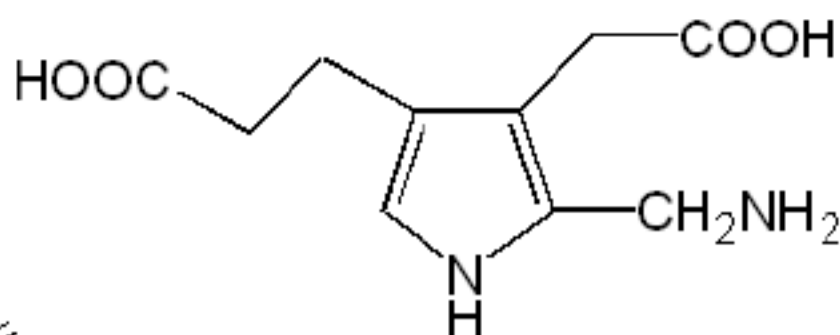
6 α ,9 α -Difluor-11 β ,17 α -dihydroxi-16 α -methyl-21-trimethyl-acetoxy

acet(yl) = CH₃CO

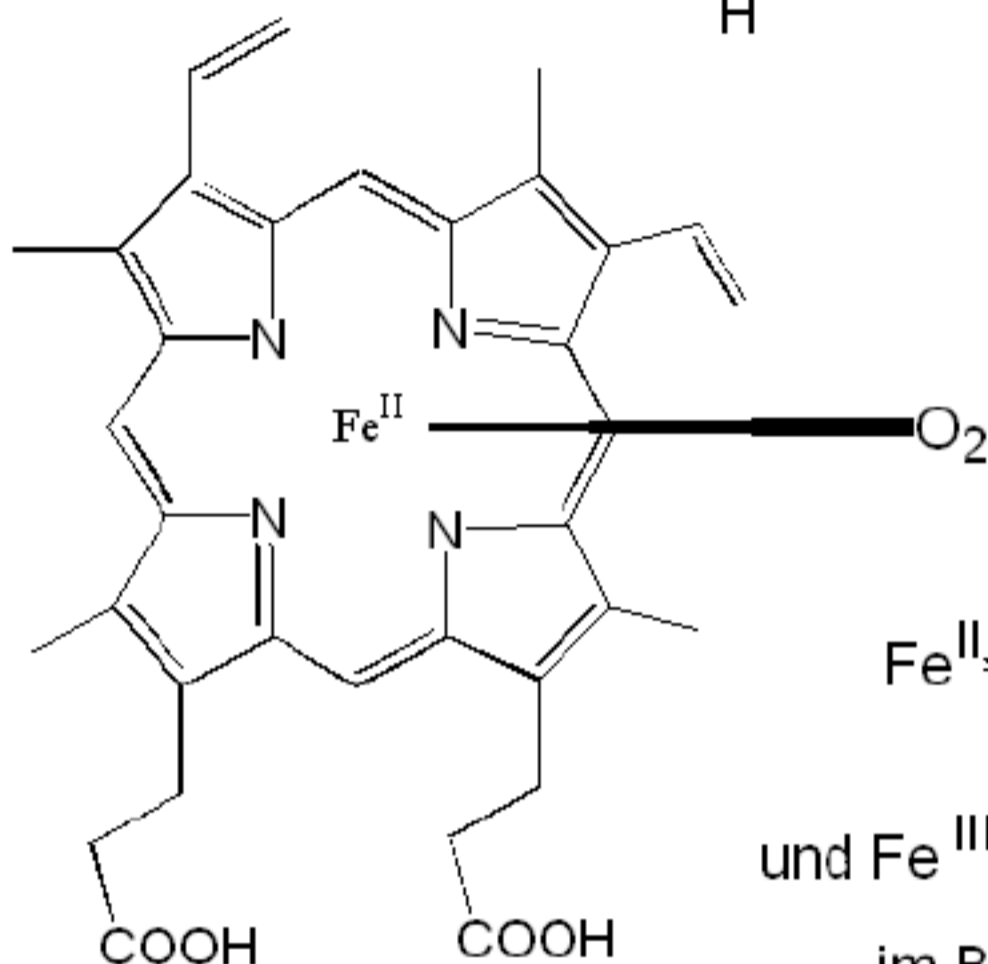
acetoxy = CH₃C(=O)O

trimethylacetoxy = (CH₃)₃C-C(=O)O

Porphyrine



Porphobilinogen



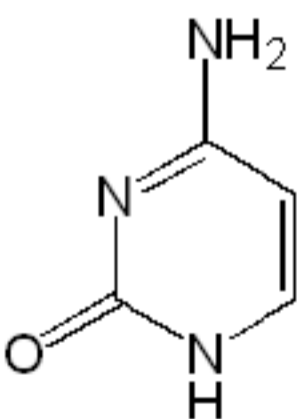
Häm

(redoxaktives Fe^{II}-Ion)Fe^{II} ⇌ Fe^{III} in Cytochromen

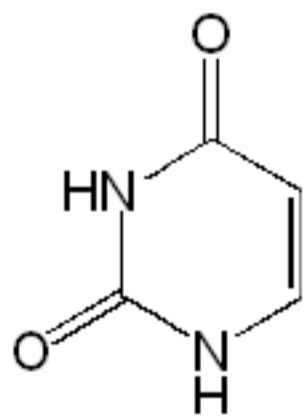
und Fe^{III} + ·O₂ ⇌ Fe^{III}-O₂⁻

im Blut (diamagnetisch)

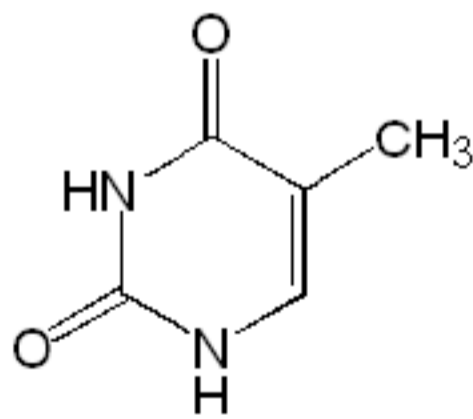
Nucleinbasen



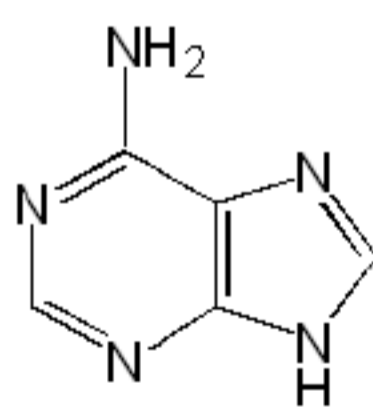
Cytosin



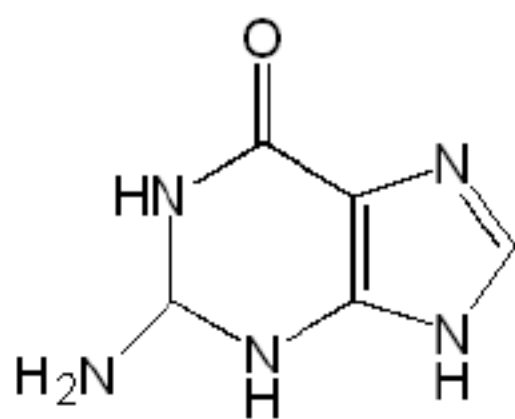
Uracil



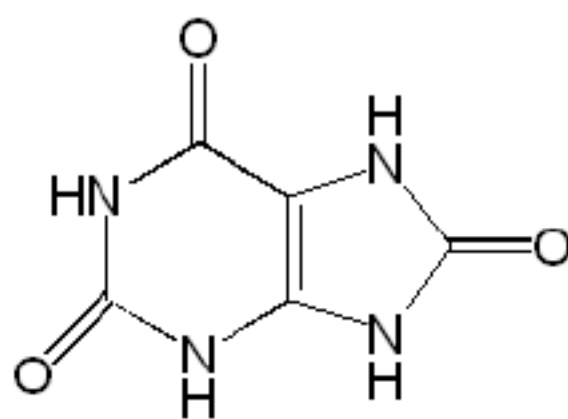
Thymin



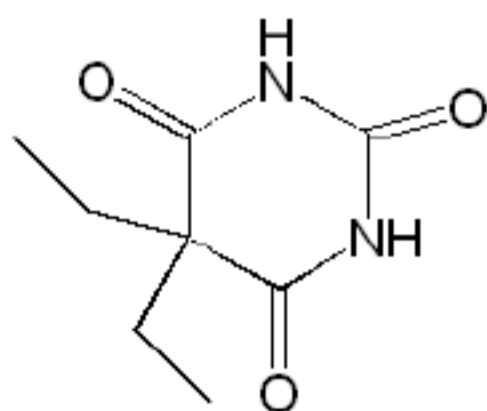
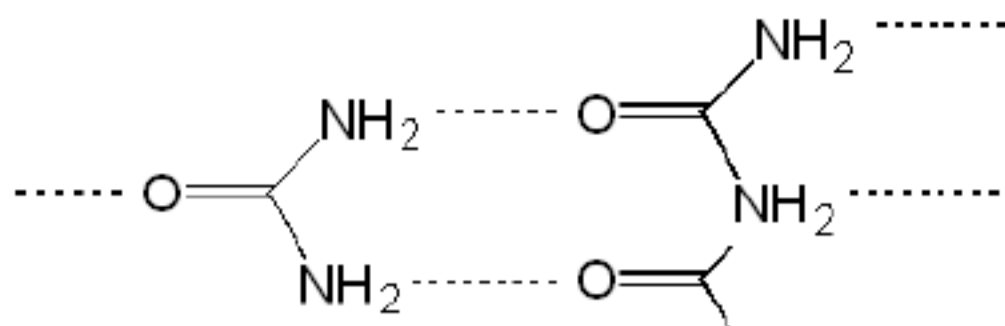
Adenin



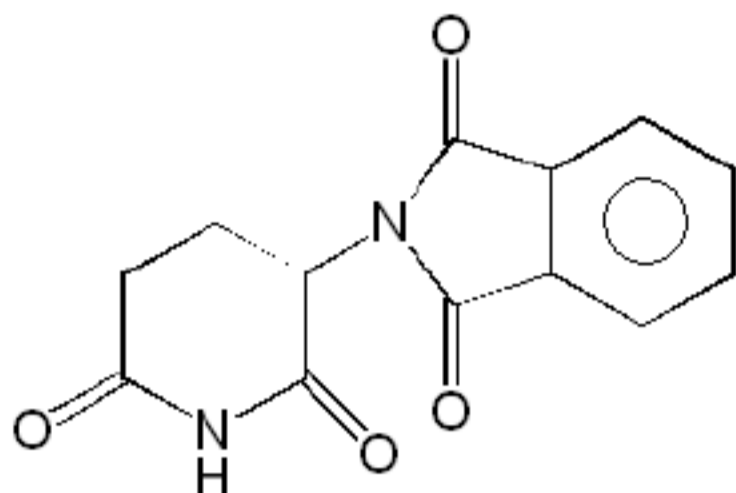
Guanin



Harnsäure



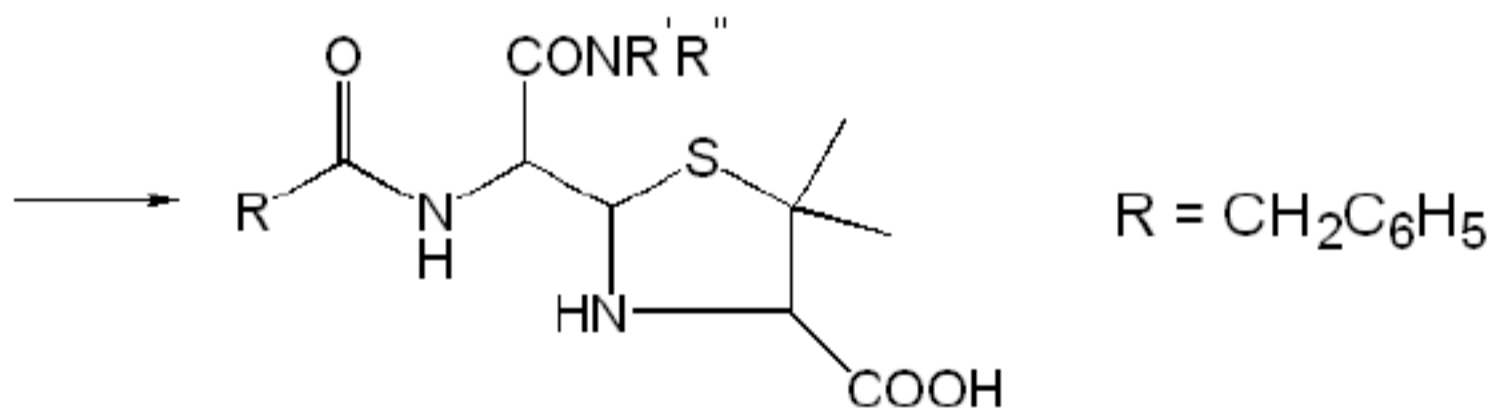
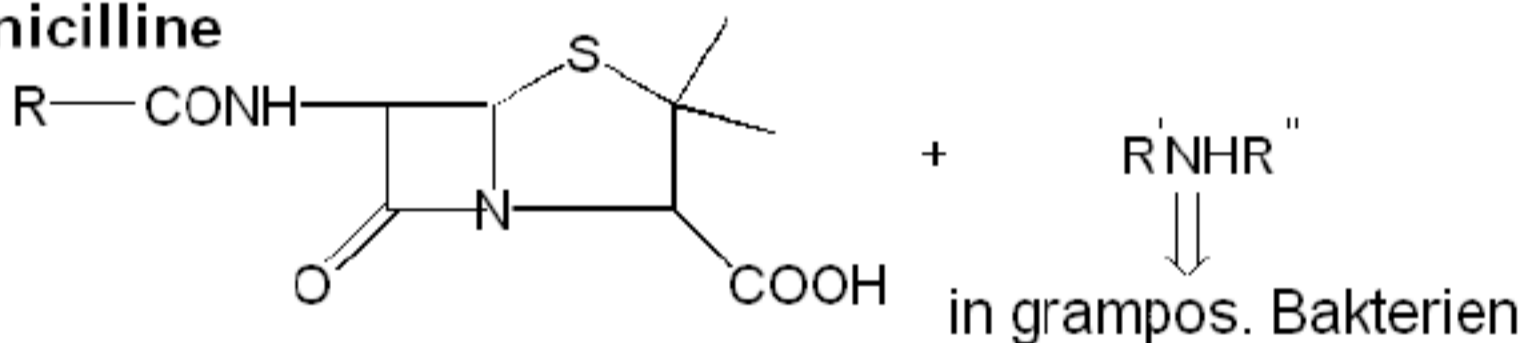
Barbital
(Veronal^R)



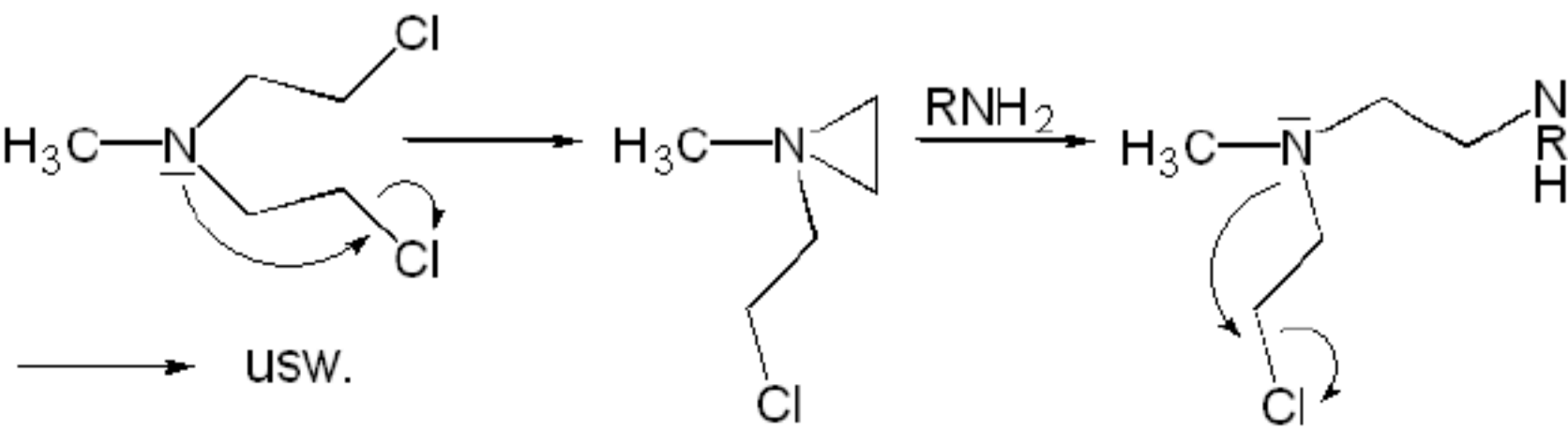
Thalidomid
(Contergan^R)

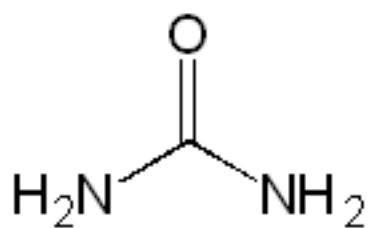
Chemotherapeutika (kovalente Bindungen)

Penicilline

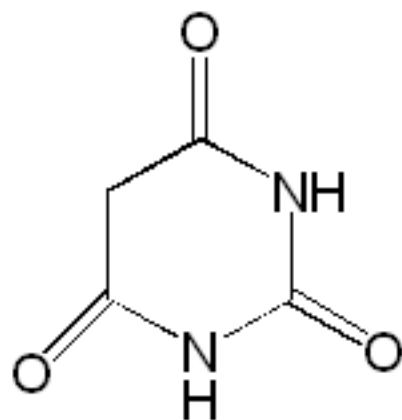


N-Lost, Aziridine

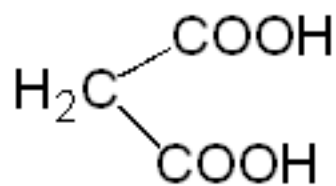




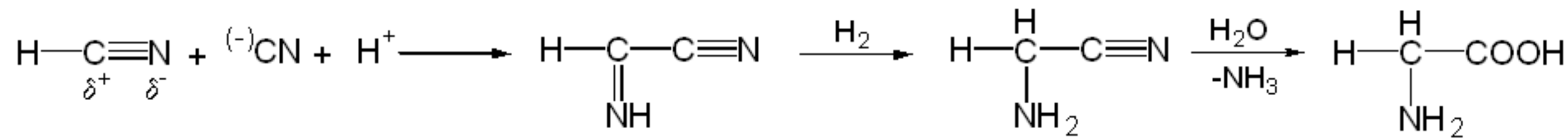
Harnstoff



Barbitursäure



Malonsäure



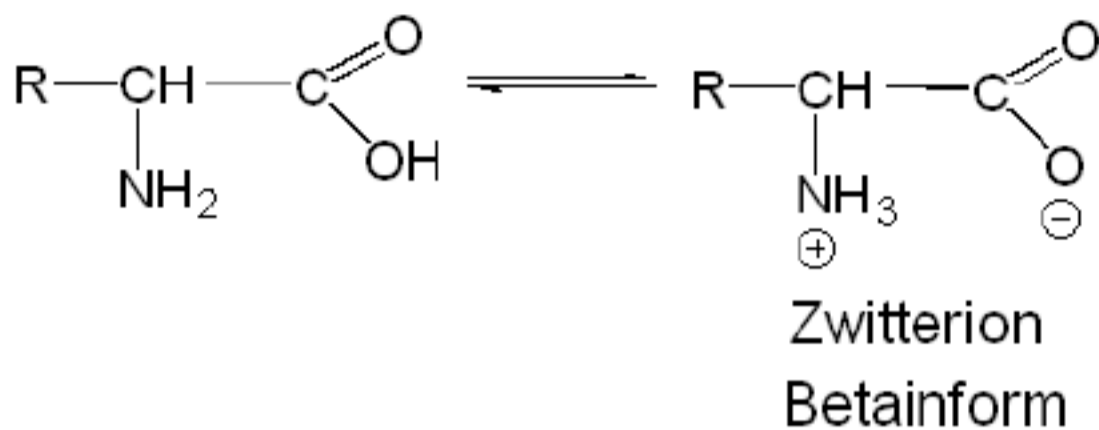
H_2 , NH_3 , H_2O , CH_4

(CO , CO_2)

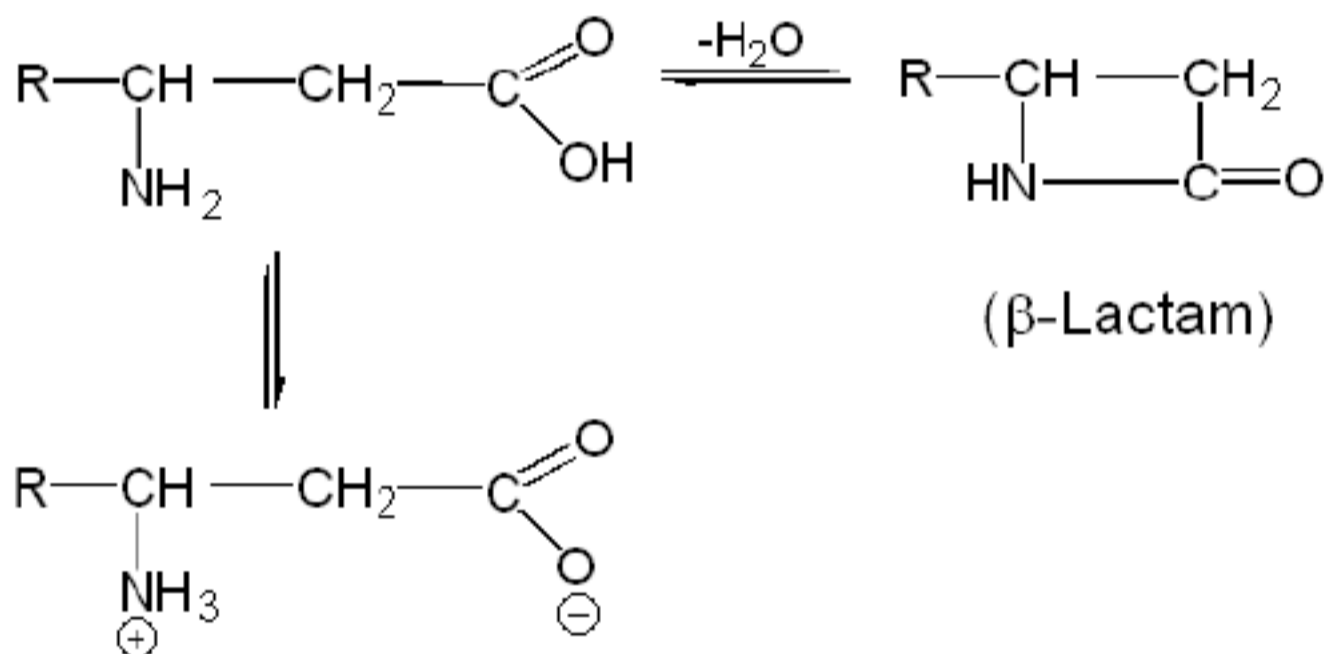
Aminosäuren

sind bisfunktionell (basisch und sauer)

α -Aminosäuren

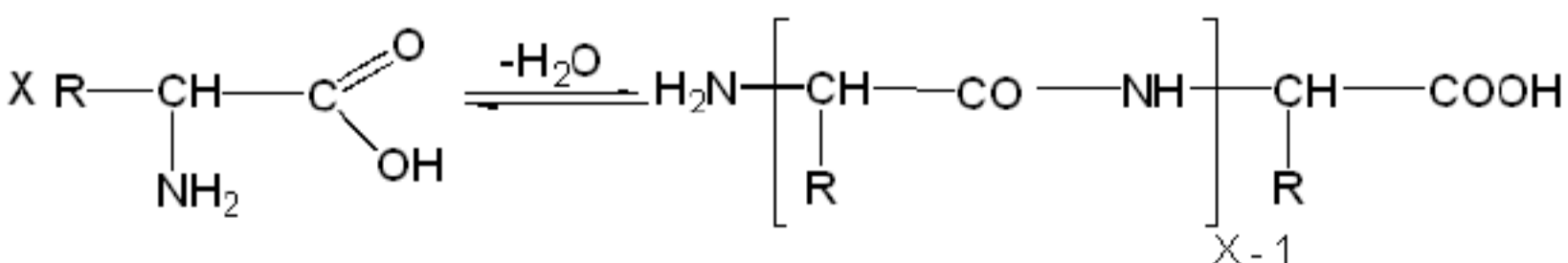


β -Aminosäuren



γ - und δ -Aminosäuren bilden analog 5- bzw. 6-Ring Lactam e

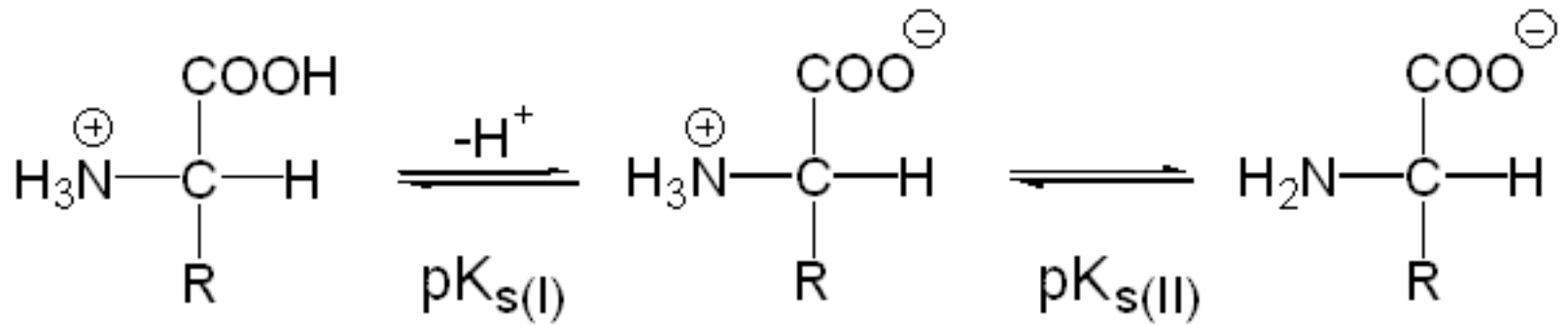
Polymerisation



Primärstruktursequenz

Polyamid

Polypeptid , Protein



Kation

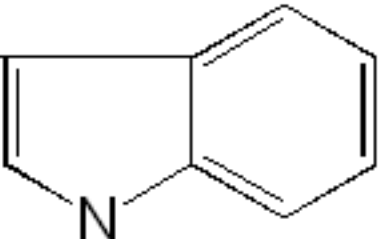
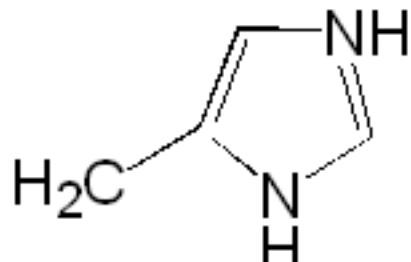
Zwitterion

Anion

$$n(+)=n(-)$$

isoelektrische Punkte

$$\text{pH}_{\text{IP}} = \frac{\text{pK}_{\text{s(I)}} + \text{pK}_{\text{s(II)}}}{2} \quad \text{niedrigste Löslichkeit in Wasser}$$

<u>-R</u>	<u>Name</u>	<u>Abkürzung</u>	<u>Charakter</u>
-H	Glycin	Gly	neutral
-CH ₃	Alanin	Ala	neutral
-CH ₂ C ₆ H ₅	Phenylalanin	Phe	neutral, hydrophob
-CH ₂ -SH	Cystein	Cys	neutral, hydrophob
-CH ₂ -S-S-CH ₂	Cystin	(Cys) ₂	neutral, hydrophob
-H ₂ C- 	Tryptophan	Trp	neutral, hydrophob
-(CH ₂) ₂ CONH ₂	Glutamin	Gln	neutral, hydrophil
-(CH ₂) ₂ COOH	Glutaminsäure	Glu	sauer, hydrophil
-(CH ₂) ₄ NH ₂	Lysin	Lys	basisch
H ₂ C- 	Histidin	His	"neutral", hydrophil

		pK_A(I) (-COOH)		pK_A(II) (NH ₃ ⁺)	
Gly		2,35		9,78	
Ala		2,35		9,87	
Cys	—	1,86	—	8,35	— 10,34 (-SH)
Phe		2,58		9,24	
Glu	—	2,13	— 4,32 (-COOH)	9,95	
Gln		2,17		9,13	
Lys	—	2,16	—	9,20	— 10,8 (NH ₃ ⁺)
His	—	1,81	— 6,05 (Imidazol H ⁺)	9,15	