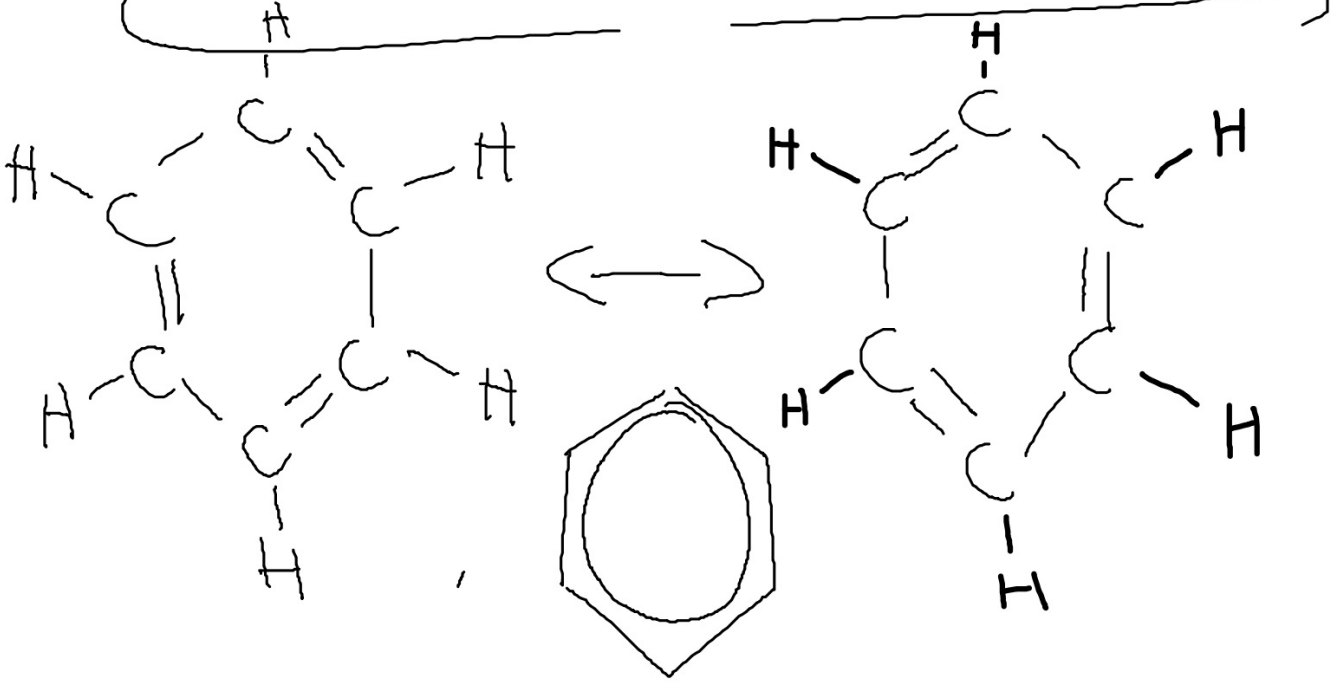
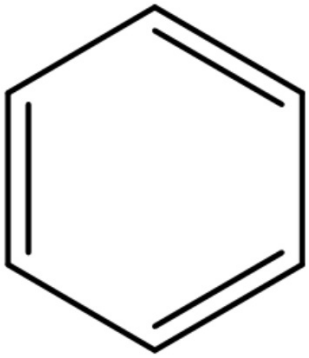
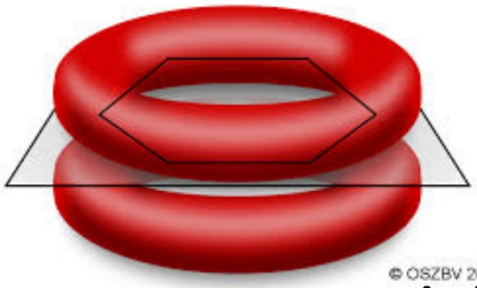
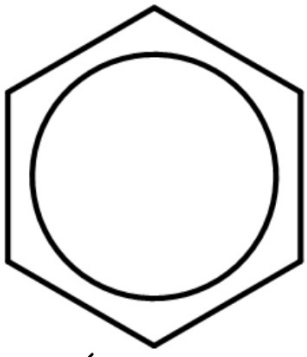
Aromatische Kohlenwasserstoffe



Aromatischer Kohlenwasserstoff: Benzol C_6H_6

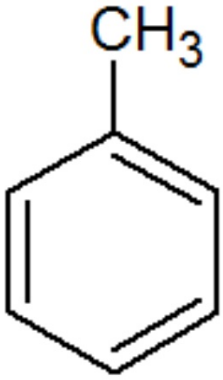


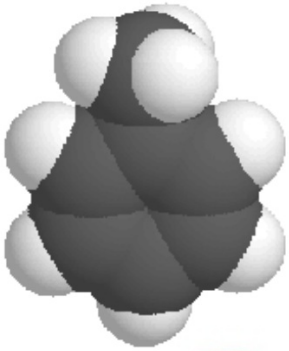




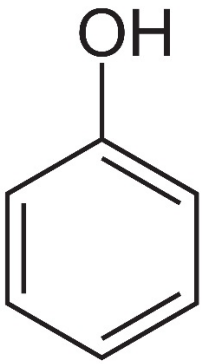
delokalisierte Elektronen

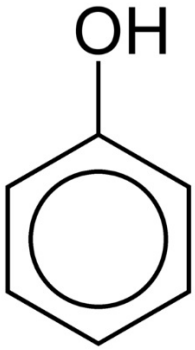
Aromatischer Kohlenwasserstoff: Toluol (Methylbenzol) $C_6H_5CH_3$



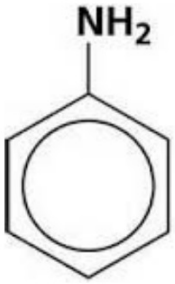


Aromatischer Kohlenwasserstoff: Phenol (Hydroxybenzol) C_6H_5OH

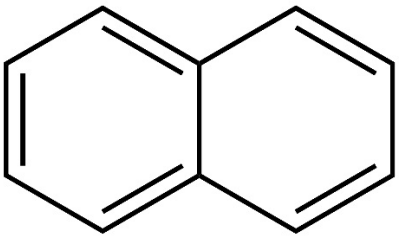


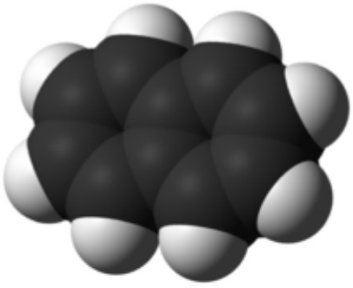


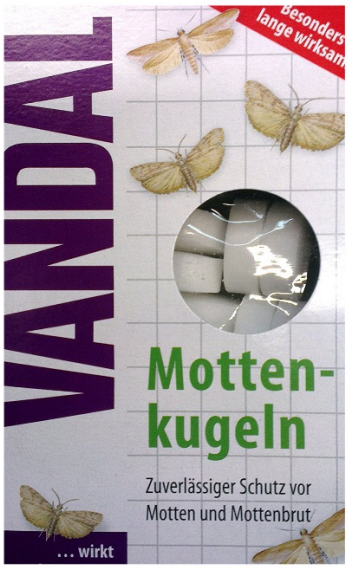
Aromatischer Kohlenwasserstoff: Anilin (Aminobenzol) $C_6H_5NH_2$



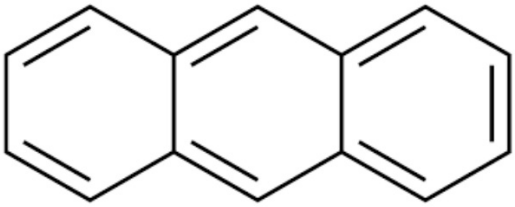
Aromatischer Kohlenwasserstoff: Naphthalin $C_{10}H_8$



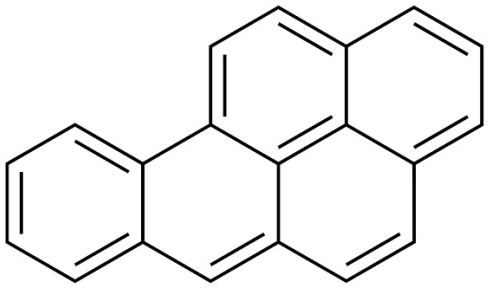




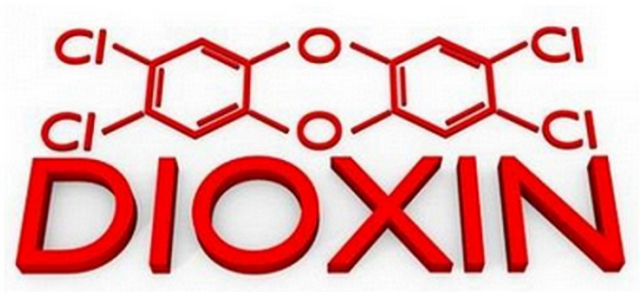
Aromatischer Kohlenwasserstoff: Anthracen $C_{14}H10$



Aromatischer Kohlenwasserstoff: Benzpyren $C_{20}H_{12}$



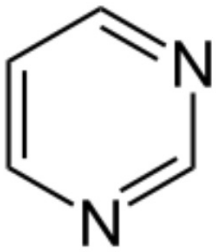
Aromatischer Kohlenwasserstoff: TCDD $C_{12}H_4O_2Cl_4$

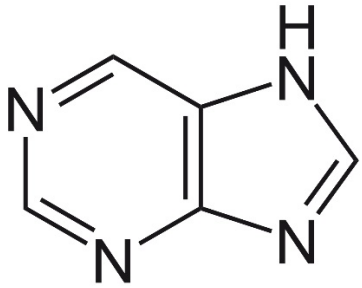


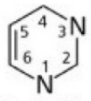
1965 – 1970: Versprühen von Agent Orange im Vietnamkrieg

1976: Chemieunfall in Italien

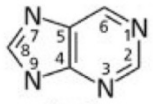
Aromatische (heterocyclische) Kohlenwasserstoffe: Pyrimidin + Purin



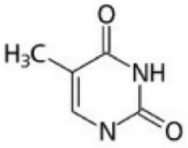




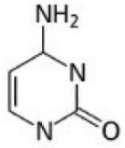
Pyrimidin



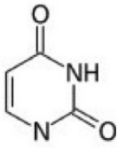
Purin



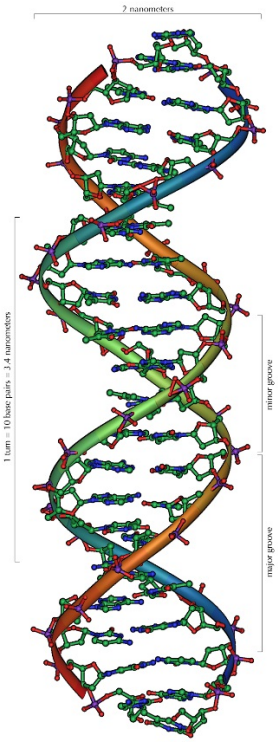
Thymin T
(DNA)

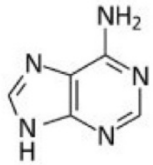


Cytosin C
(DNA, RNA)

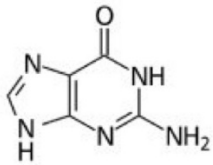


Uracil U
(RNA)



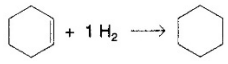
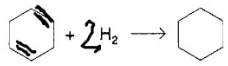
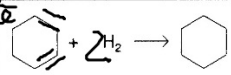
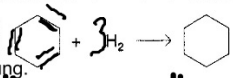
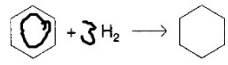


Adenin A
(DNA, RNA)



Guanin G
(DNA, RNA)

Mesomerieenergie am Beispiel Benzol

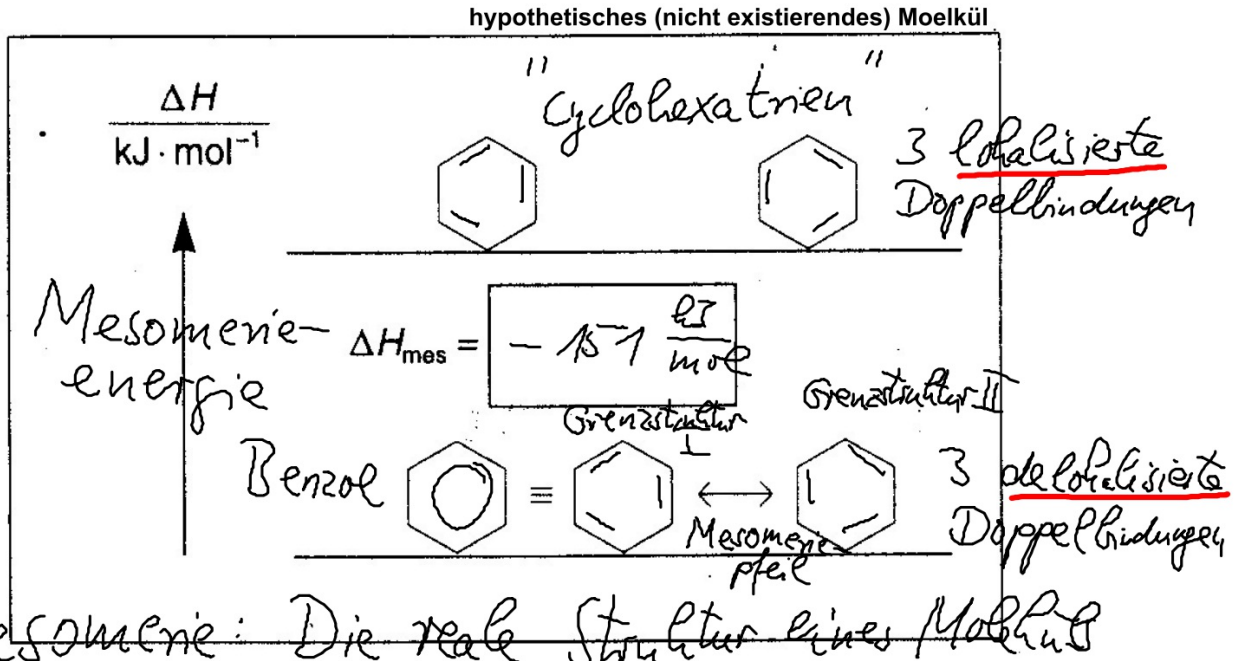
Reaktionsgleichung	ΔH_m^0 (abgeschätzt) / kJ · mol^{-1}	ΔH_m^0 (gemessen) / kJ · mol^{-1}
 Cyclohexen → Cyclohexan		−120
 Cyclohexa-1,4-dien → Cyclohexan	−240 (2 · 120)	−240
 Cyclohexa-1,3-dien → Cyclohexan	−240 (2 · 120)	−232
 Cyclohexa-1,3,5-trien → Cyclohexan (hypothetischer (nicht existierender) Stoff)	−360 (3 · 120) (hypothetische Reaktion)	
 Benzol → Cyclohexan		−209
Mesomerieenergie von Benzol:	−360 − (−209) = −151 kJ/mol	

konjugierte Doppelbindung

Abfolge von C–C-Einfachbindung und C=C-Doppelbindung.

Die Verteilung von Elektronen über einen größeren Raum bringt einen Energiegewinn.
Je größer das System aus konjugierten Doppelbindungen ist, desto größer ist dieser Energiegewinn.
Beim Benzol-Molekül sind 6 Elektronen (2 aus jeder der 3 Doppelbindungen) über das gesamte Ringsystem verteilt (delokalisiert).

Darstellung der Mesomerieenergie des Benzols im Enthalpiediagramm



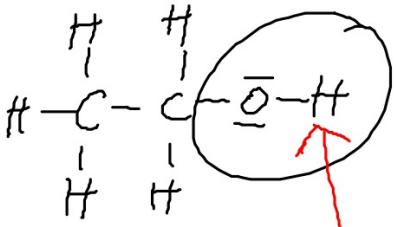
Mesomerie: Die reale Struktur eines Moleküls lässt sich (nur) näherungsweise durch mesomere Grenzstrukturen beschreiben

Anwendung: Acidität von Phenol (Hydroxybenzol)

abspaltbares H-Atom

schwache Säure

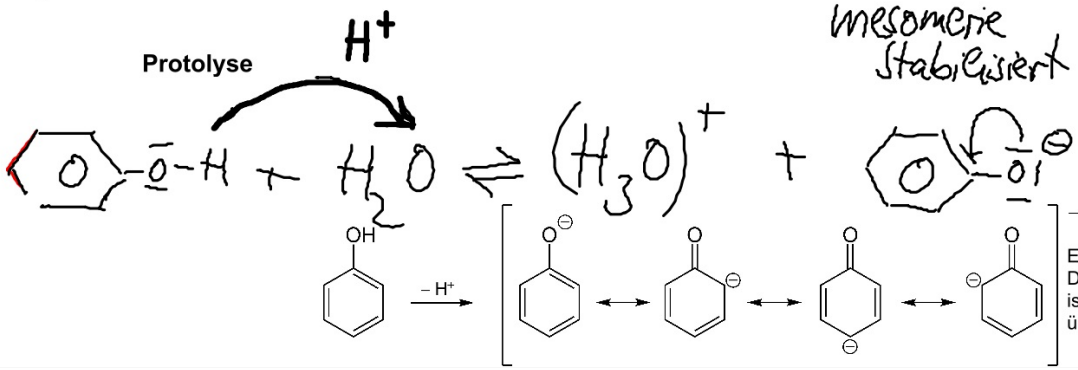
$pK_s = 10$



keine Säure

nicht abspaltbar

aber: keine Carboxy-Gruppe!!!



Energiegewinn:
Die negative Ladung ist durch Mesomerie über 7 Atome verteilt.