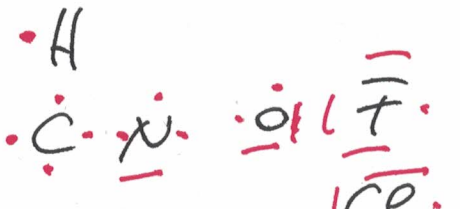
Organische Chemie (OC)

OC: Papier, Traubenzucker, PET-Flasche
Parfüm, Erdöl, Baumwolle, Haare

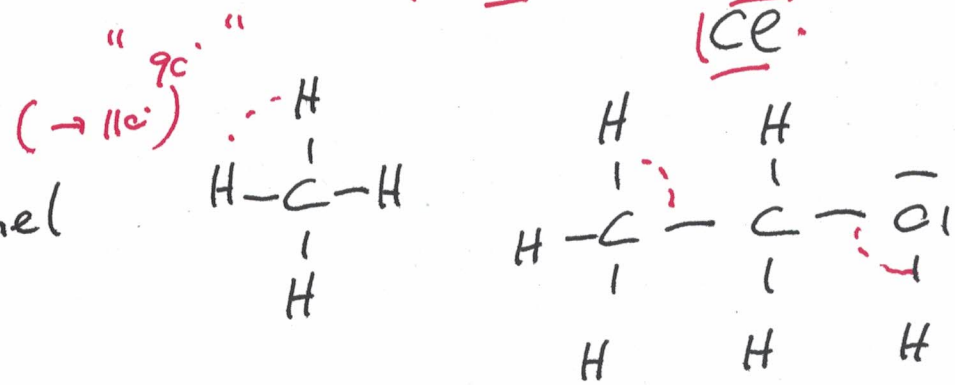
AC: Glas, Aluminium, Wasserfarbe
Wasser, Kochsalz

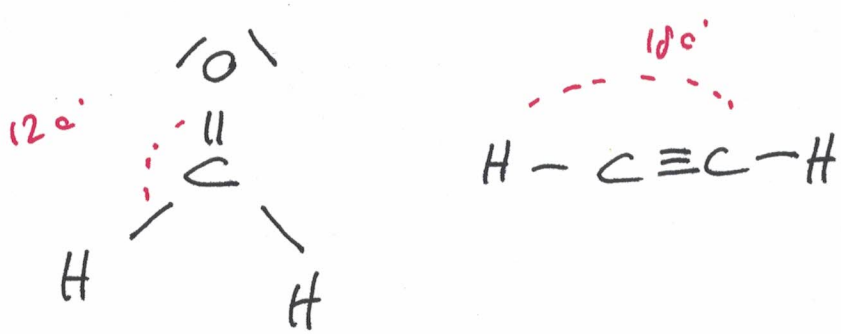
OC: Moleküle enthalten das Element Kohlenstoff

- Valenzelektron(en)

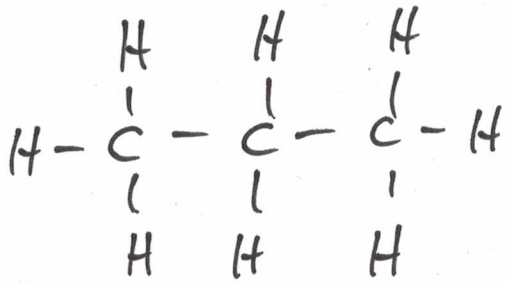


- Lewisformel

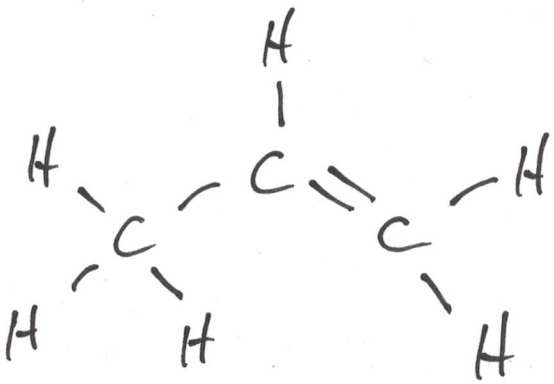




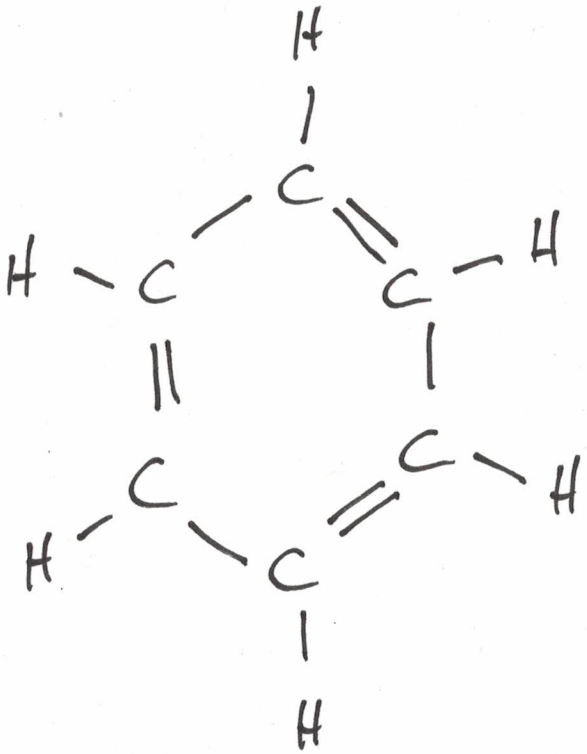
Skelett / Summenformel / Lewis

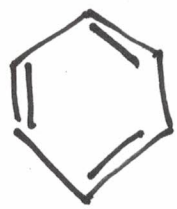


C_3H_8

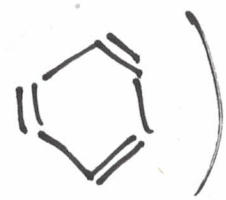


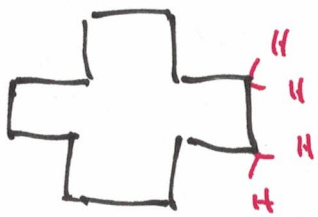
C_3H_6



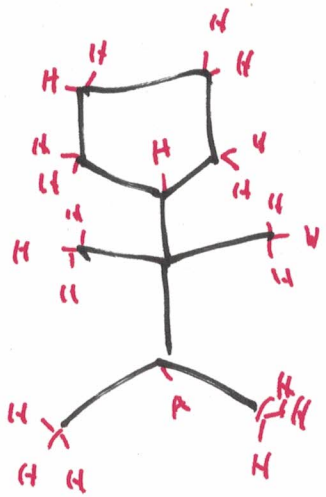


C_6H_6

Lewis: 



$C_{12}H_{24}$



$C_{11}H_{22}$

OC

✗ 1 Nachbar ...

2 Nachbarn → 90°

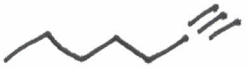
3 " → 120°

4 " → 110° (gezeichnet 90°)

Bindungsmöglichkeiten

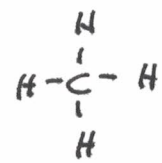
C-C; Einfachbindung, z.B.  Alkan

C=C; Doppelbindung, z.B.  Alken

C≡C; Dreifachbindung, z.B.  Alkin

Anzahl C-Atome

gasförmig

1  Methan

2 / Ethan

3  Propan

4  Butan

flüssig

5  Pentan

6  Hexan

7  Heptan

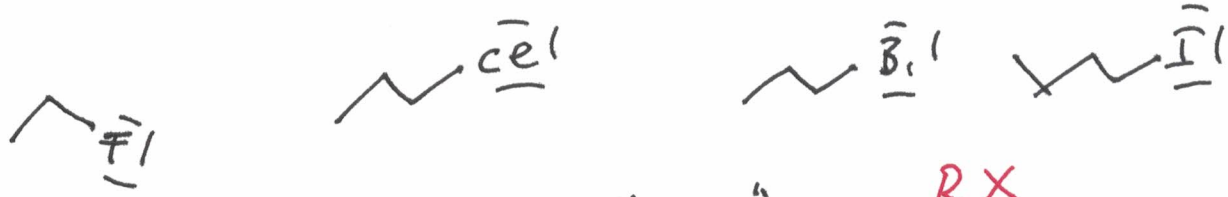
8  Octan

9  Nonan

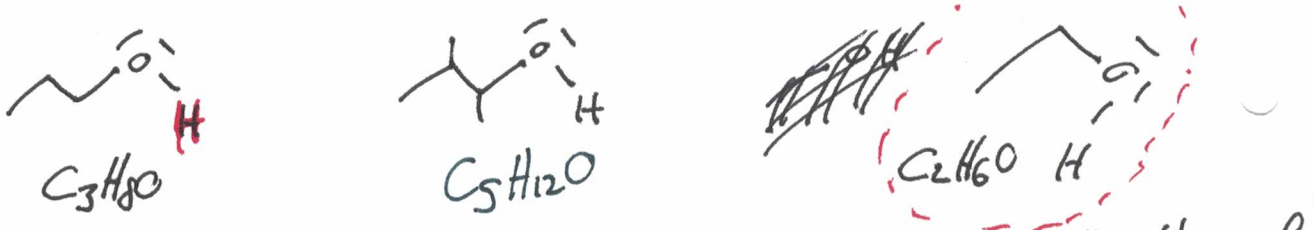
10  Decan

fest | ~ 20 - C-Atome

- "Eine Einfachbindung zwischen C und einem elektronegativeren Atom"



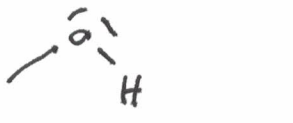
funktionelle Gruppe: "Halogenalkan" — RX — X steht für F, Cl, Br, I



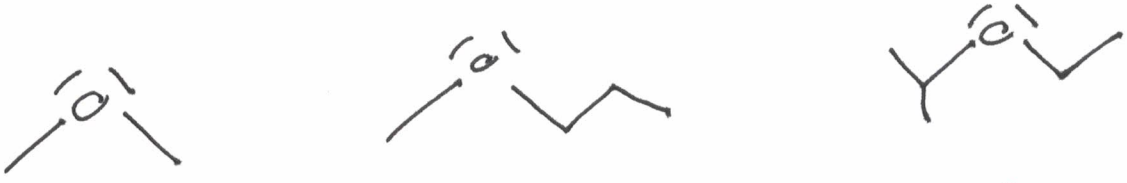
C_3H_8O "Propanol" — $C_5H_{12}O$ — C_2H_6O "Ethanol"

"Alkohol" → "ol"

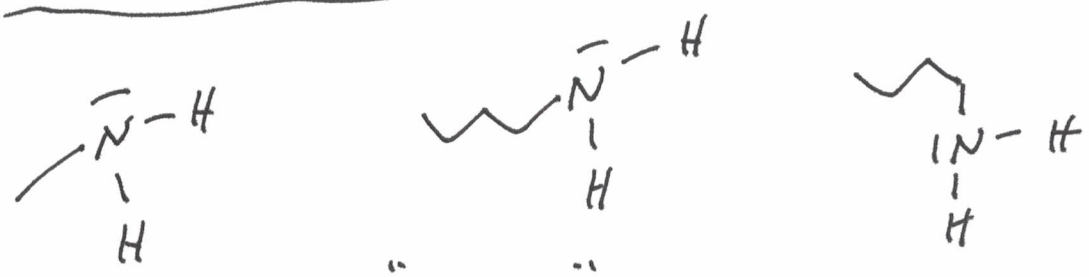
funktionelle Gruppe — ROH



"Methanol"

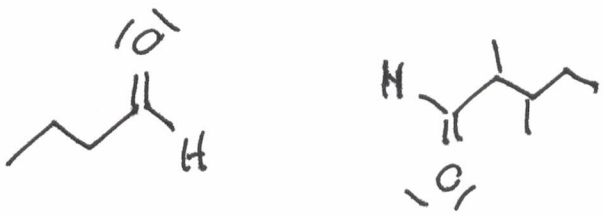


"Ether" — ROR



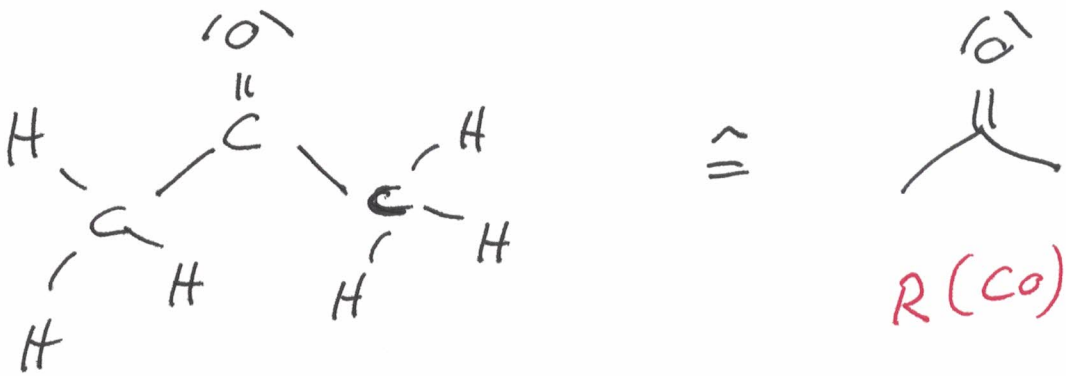
"Amin" — RNH_2

- Doppelbindung zwischen C + O: C=O



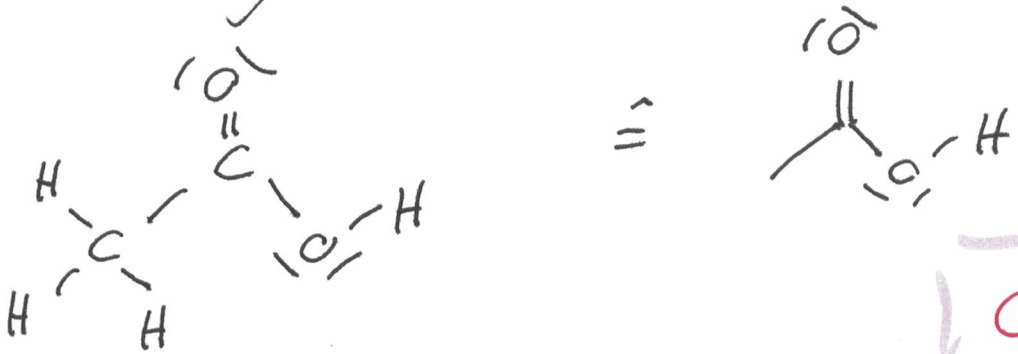
R(CO)H

Aldehyd



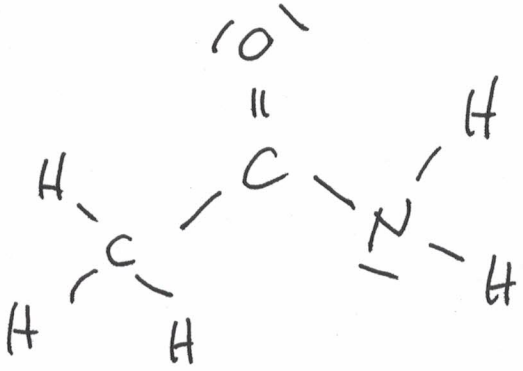
R(CO)R

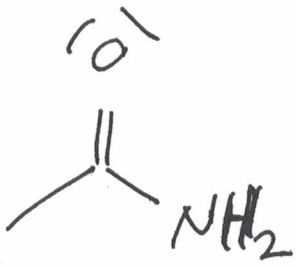
Keton



R(CO)OH

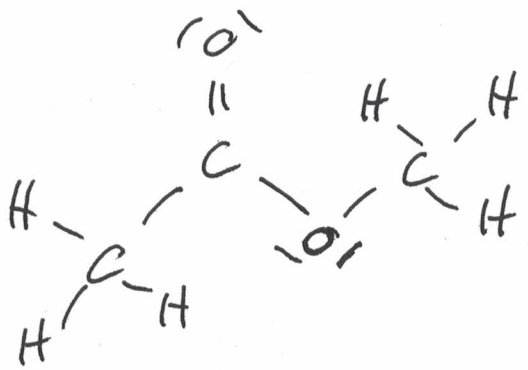
Carbonsäure

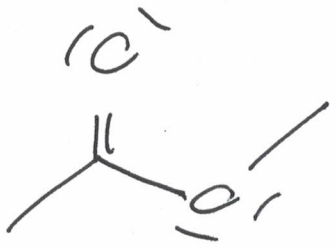




$R(CO)NH_2$

"Amid"





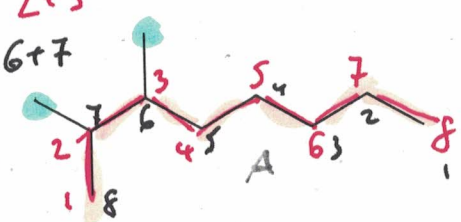
$R(CO)OR$

Ester

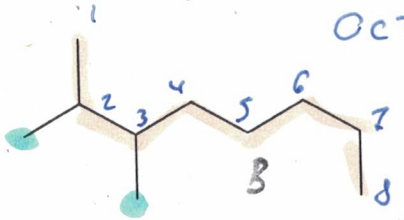
2.1 Gemäss der Theorie der kovalenten Bindungen herrscht um jede C-C-Einfachbindung freie Drehbarkeit. Kohlenwasserstoff-Moleküle sind von daher sehr beweglich. Logischerweise kann man ein bestimmtes Kohlenwasserstoff-Molekül auf sehr viele Arten aufzeichnen. Die folgenden Skelettformeln stellen bis auf eine Ausnahme alle das selbe Molekül dar. Welches Molekül ist ist hier fehl am Platz?

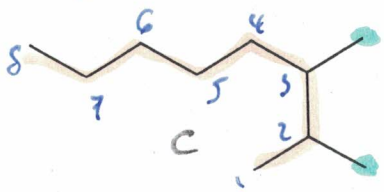
Methyl-Gruppen bei: 2+3
" - " bei: 6+7

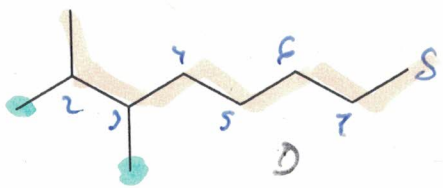
2,3-Di:-Methyl-Octan

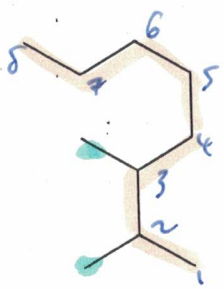


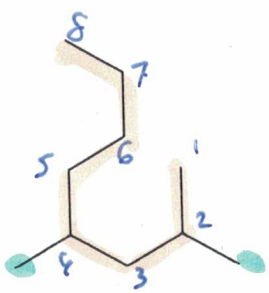
2,3-Di:-Methyl-Octan







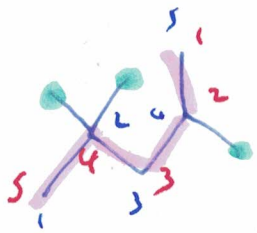




2,4-Di:-Methyl-Octan

längste Kette: 8C → Octan – Hauptkette

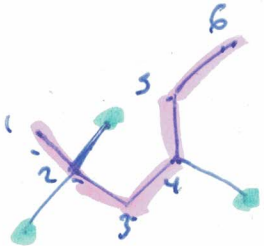
- jeweils 2 Seitenketten ("Substituenten")
  jeweils 1 Kohlenstoff: Methan → "Methyl"

a) 

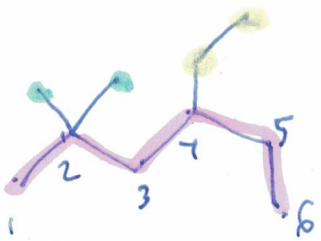
- 5C Pentan
- 3× CH_3 - Rest

2,4,4-Tri-Methyl-Pentan

2,2,4 "

b) 

- 6C Hexan
- 3× CH_3 - Rest

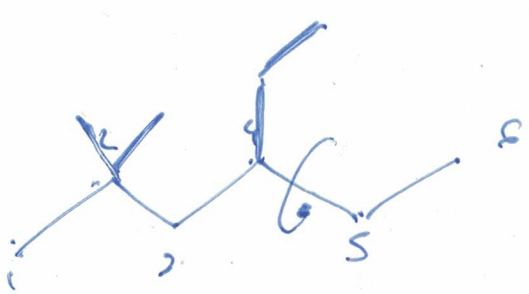
c) 

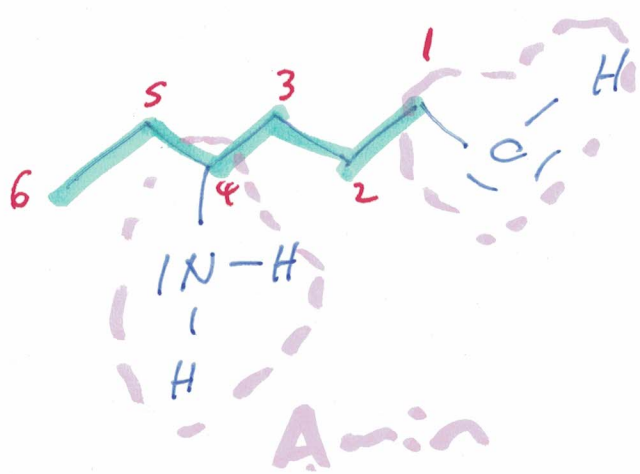
- 6C Hexan
- 2× CH_3 - Rest Methyl
- 1× CH_2-CH_3 Ethyl

a) 2,2,4-Tri-Methyl-Pentan

b) 2,2,4 Tri-Methyl-Hexan

c) 4-Ethyl — 2,2-Di-Methyl — Hexan





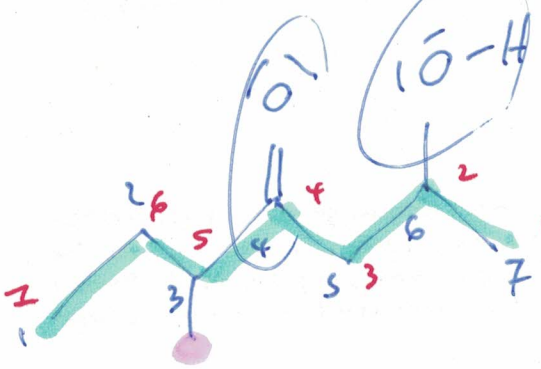
• 6C → Hexan

Position 1 : Alkohol
" 4 : Amin

"4-Amino - Hexan - 1-ol "
" Amin - Hexan - Alkohol

Präfix - "Hauptkette" - Suffix

	Präfix	Suffix
funkt. Gruppe		
Alkohol	Hydroxy -	-ol
Keton	Oxo -	-on
Aldehyd	Formyl -	-al
Amin	Amino -	-amin



Alk

3-Methyl-

6 Hydroxy - Hepten - 4-on

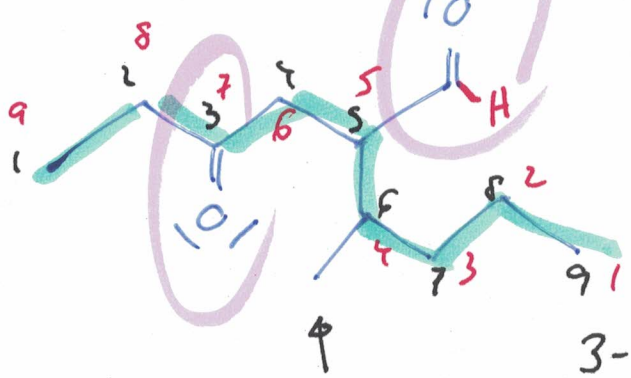
Methyl-Rest

Hepten

2-Hydroxy - 5-Methyl-4-on

Keton

Aldehyd!



9 C → Nonan

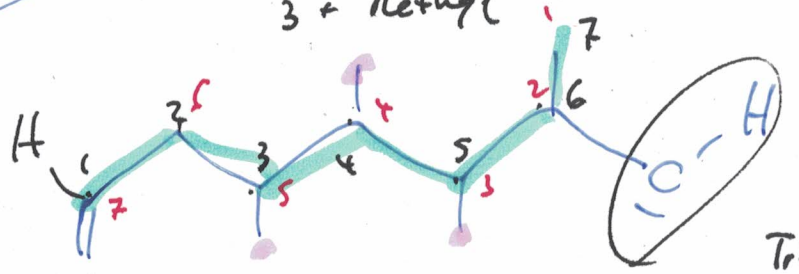
Oxo - Nonan - al

Methyl

3-Oxo-6-Methyl-Nonan-5-

(7-Oxo-4-Methyl-Nonan-5-al)

3-Methyl



~~6 C → Hexan~~

7 C → Heptan

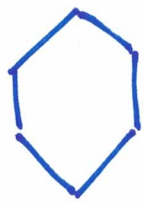
Trimethyl

Alkohol

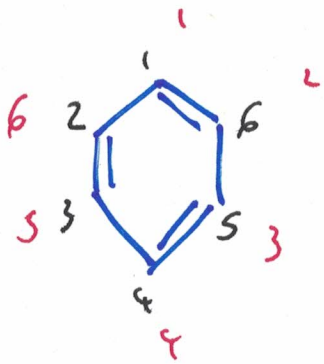
6-Hydroxy-3,4,5- - Hepten - 1-al

(2-Hydroxy-3,4,5-Trimethyl-Hepten-7-al)

Aldehyd!



Cyclo-Hexan

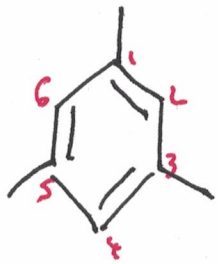


Cyclo-Hexen

Cyclo-Hex-Tri-en

Cyclo-Hexan-Tri-2,4,6-en

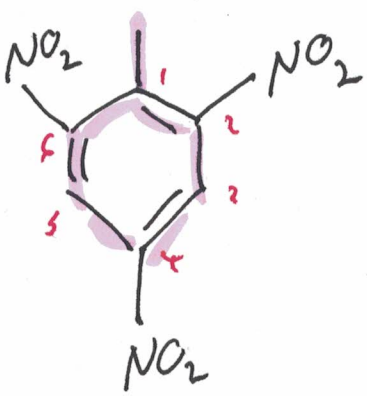
Cyclo-Hex(an)-Tri-1,3,5-en



1,3,5-Tri-Methyl-

cyclo-Hexan-Tri-1,3,5-en

"TNT"

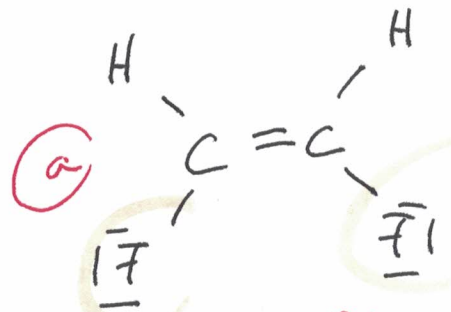


Tri-Nitro-Toluol

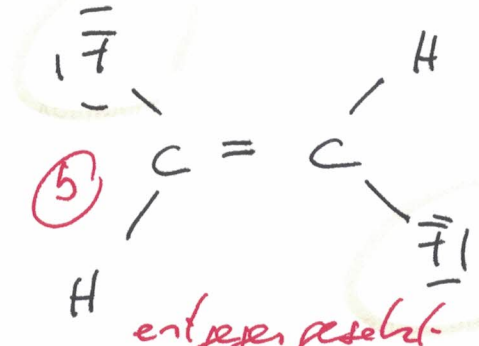
2,4,6-Tri-Nitro-1-Methyl-

cyclo-Hexan-Tri-1,3,5-en

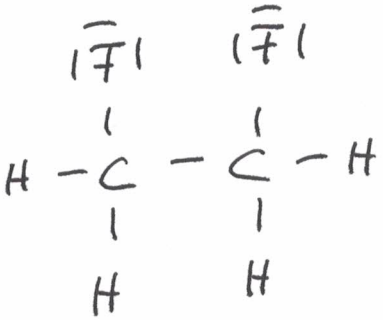
Bsp.

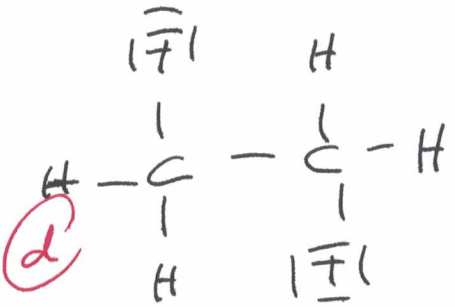


zusammen → "cis"

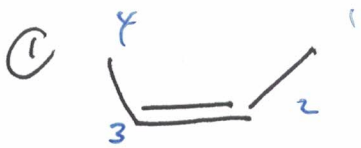


entgegengesetzt → "trans"



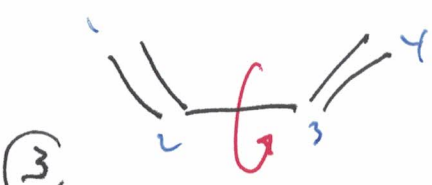


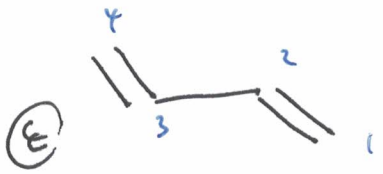
c ≡ d



cis – Buten-2-en

trans – Buten-2-en



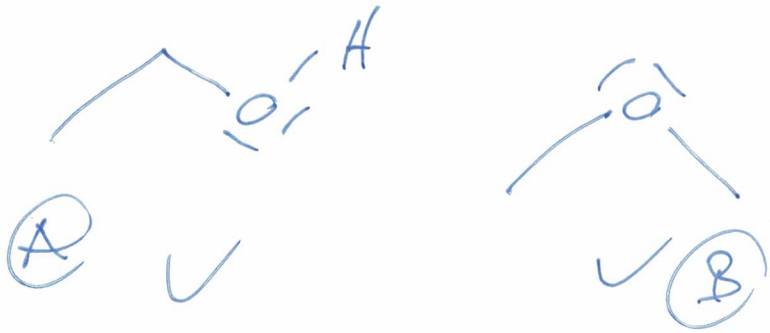


3 ≡ 4 (!)

Buten-(1,3)-Dien

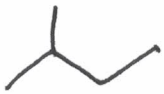
verschiedener räumlicher Aufbau,
ABER .. gleiche Summenformel!
→ "Isomer"

- C_2H_6O



gleiche Summenformel,
verschiedene funktionelle
Gruppen → Funktions-
isomer

- C_5H_{12}

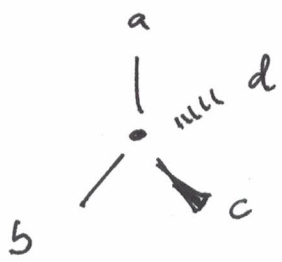


gleiche Summenformel,
unterschiedliches Skelett
→ Skelett-isomer

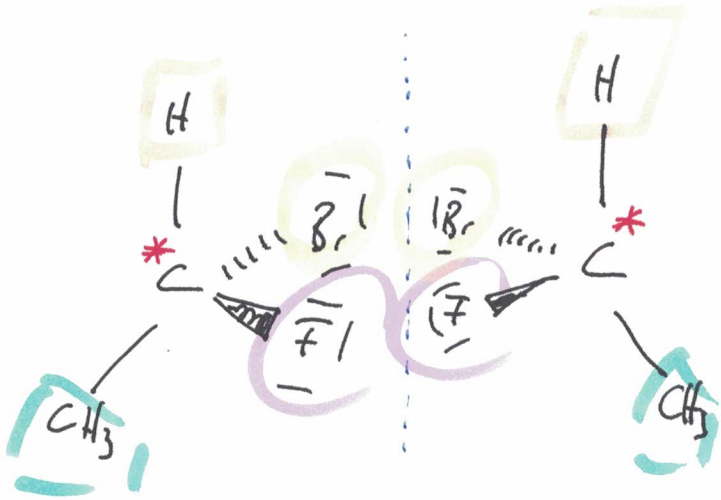
Chiralität

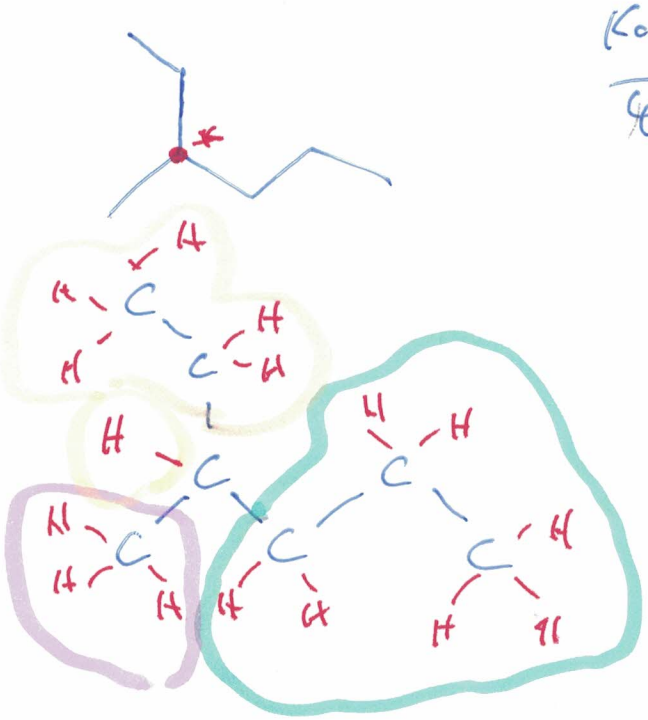
" Etp. "

Die Chiralität nennt man die Eigenschaft bestimmter Gegenstände (Moleküle), deren Bild resp. Spiegelbild durch Drehung sich nicht zur Deckung bringen lassen



z. B.



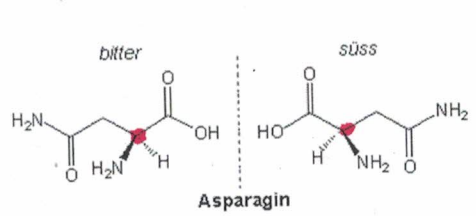


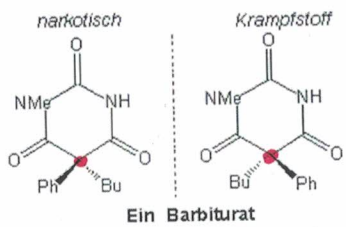
Kohlenstoffatom(!) mit 4 verschiedenen Resten ?

ja : Chiralitätszentrum *

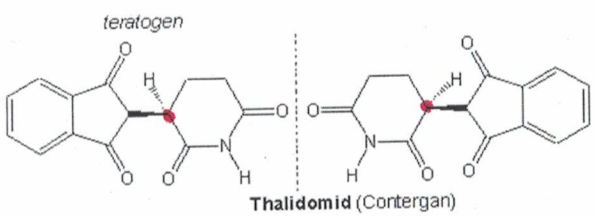
Chiralität in der Natur:
Betrachtet man Moleküle in der freien Natur, so wird sehr schnell ersichtlich, dass praktisch alle wichtigen Substanzen chiral sind. Beispiele:

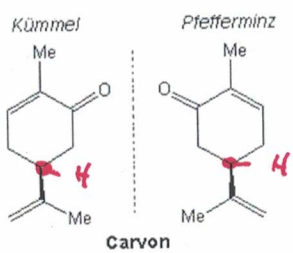
• Chiralitätszentrum



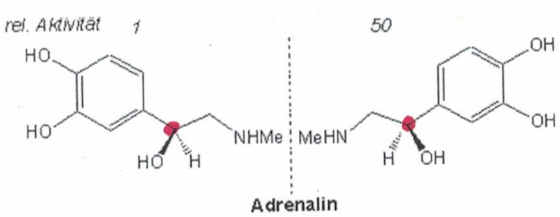


Bu
Ph : Rest

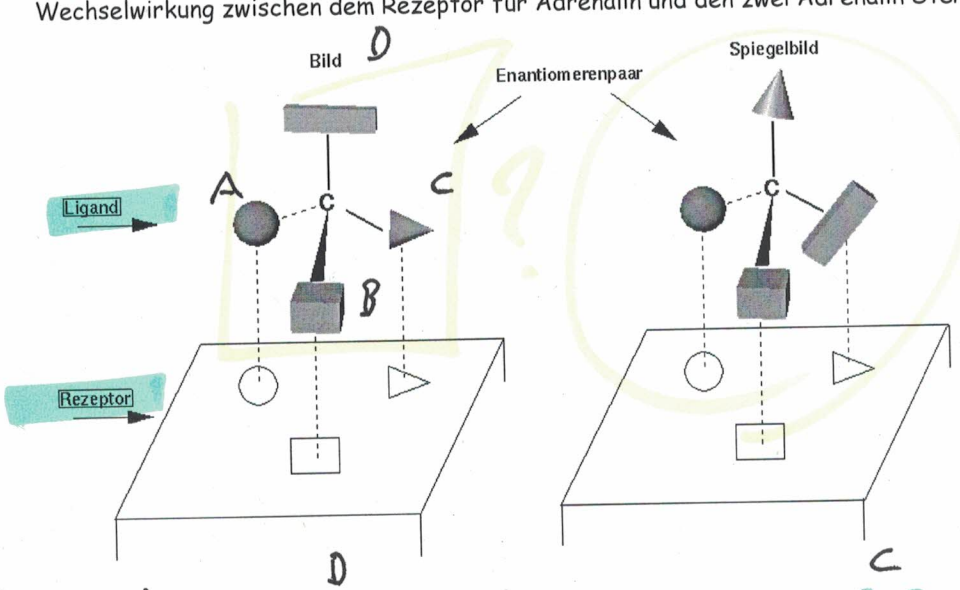


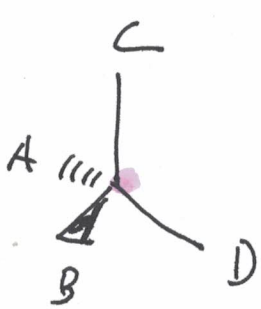


Fle: Rest



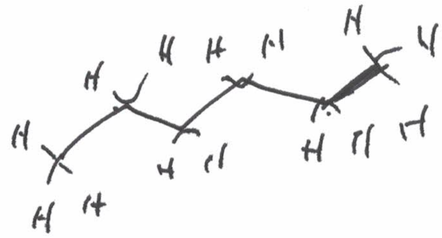
Warum haben solche Stereoisomere unterschiedliche biologische Eigenschaften? Um ihren biologischen Effekt auszuüben müssen die Moleküle mit anderen Biomoleküle (Proteinen oder DNA, z.B.) Komplexe bilden. Die Biomoleküle sind chiral! Ein chirales Molekül muss zu seinem spezifischen Rezeptor passen (wie eine Hand zu einem Handschuhe!). Zum Beispiel können wir in der folgenden Abbildung eine spezifische Wechselwirkung zwischen dem Rezeptor für Adrenalin und den zwei Adrenalin Stereoisomeren darstellen:



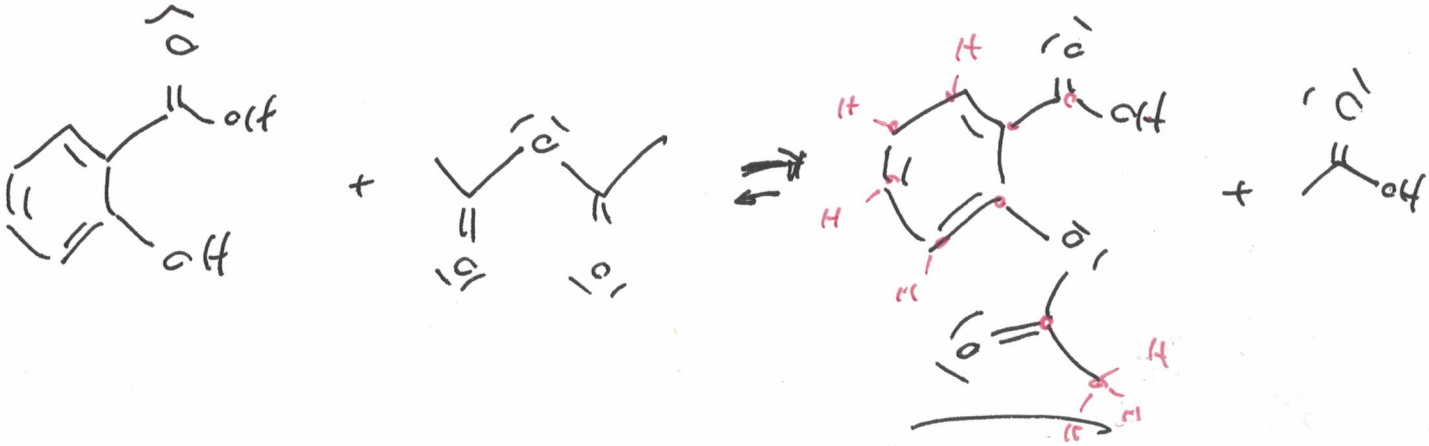


Spiegel-
bild

C_6H_6



↳ Jammer
zeggen !



0.1 mol 0.12 mol (0.1 mol)

Summenformel

$C_9H_8O_4$

$M(C_9H_8O_4) = 9 \cdot 12 + 8 \cdot 1 + 4 \cdot 16 = 180\ g/mol$

1 mol ≙ 180 g

0.1 mol ⇒ 18 g

maximale Ausbeute 100 %.

Praxis: ~ 90 % Ausbeute