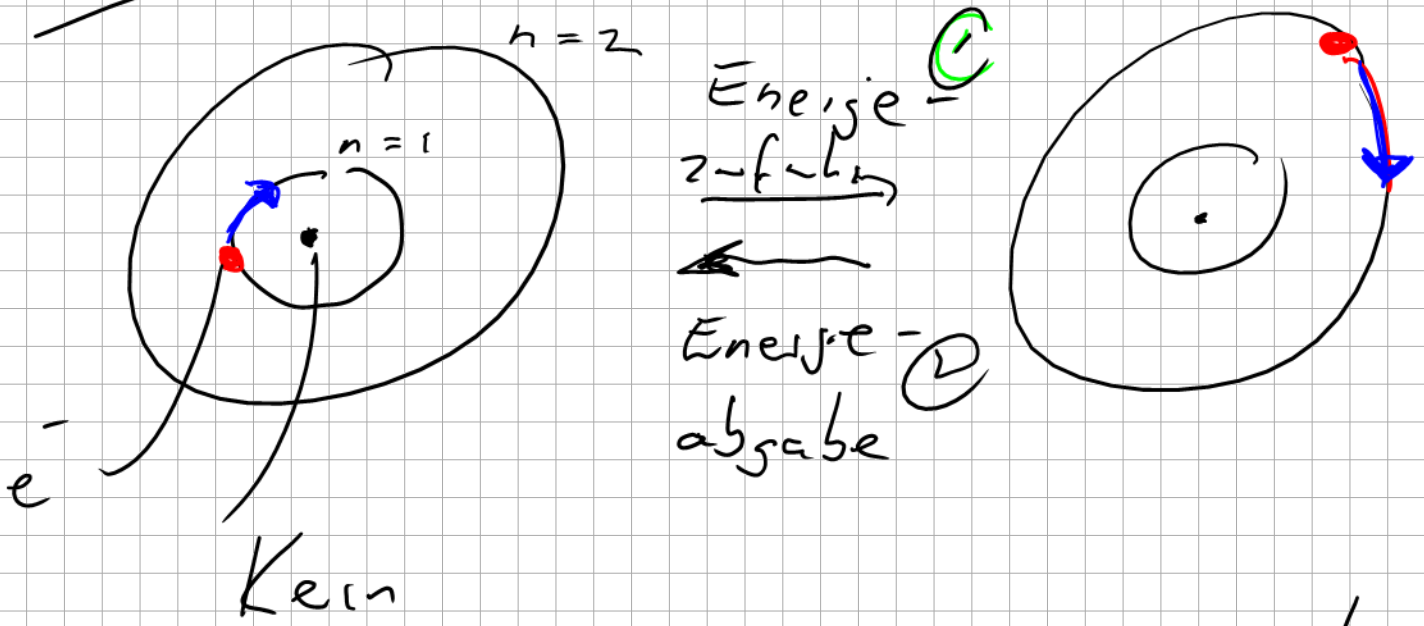
Grundexperiment

Bohr-Modell



① in Form von ... Strom

② in Form von ... Licht + Wärme

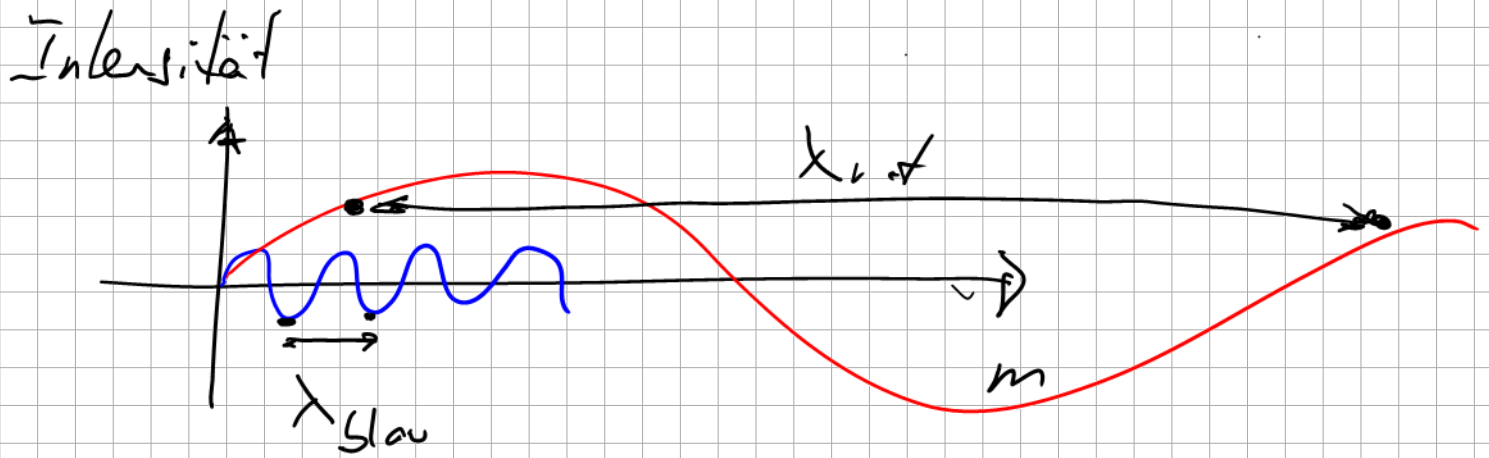
$$E_{Aufnahme} = E_{Abgabe}$$

$$E = h \cdot \frac{c}{\lambda} = h \cdot \nu$$

h : Konstante $\left(6.626 \cdot 10^{-34} \frac{J}{s}\right)$

c : Konstante (Licht $\sim 300\,000 \frac{km}{s}$)

λ : Wellenlänge



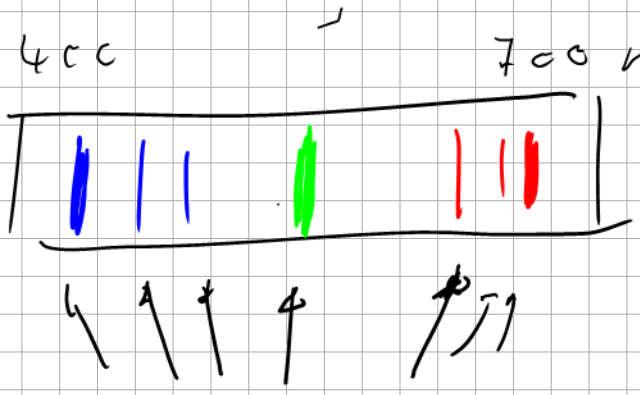
$$E_{blau} > E_{Rot}$$

Experiment
Flammenfärbung

„Handspektroskop"

verschd. Strichmuster

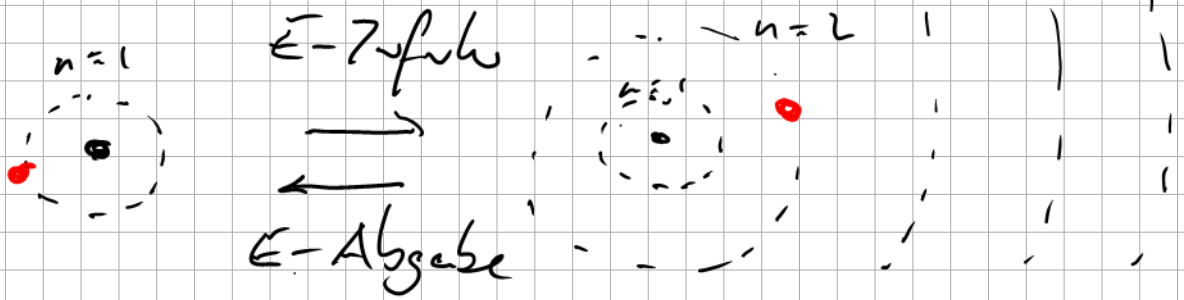
z.B.



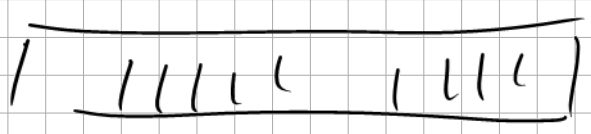
⊛ eines Elektrons

Sprung ⊛ von höherer Schale auf eine tiefere Schale

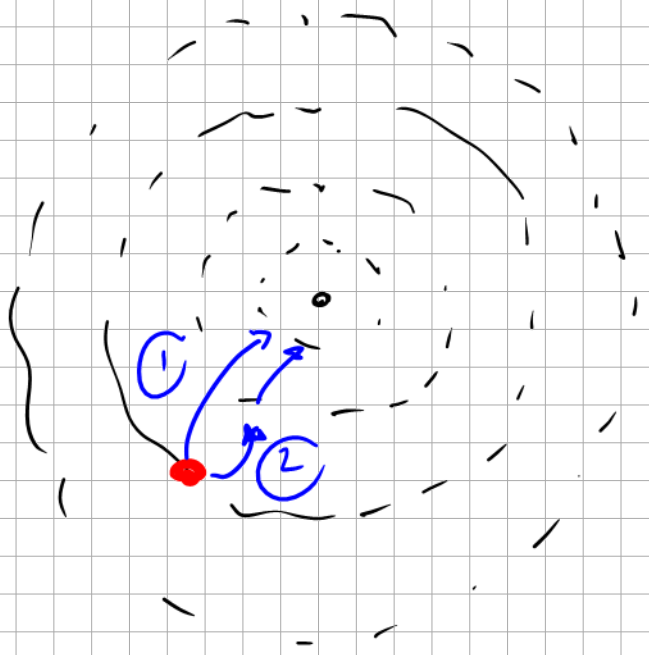
z.B. Wasserstoffatom: $1p, 1e^-$



Exp.



?!



vgl. p.64

$6.626 \cdot 10^{-34}\ Js$

$\Delta E_1 > \Delta E_2$

$\sim 3\,000\,000\ m/s$

$$\Delta E = h \cdot f = \frac{h \cdot c}{\lambda}$$

Bsp. $\Delta E = 7.8 \cdot 10^{-19}\ J$

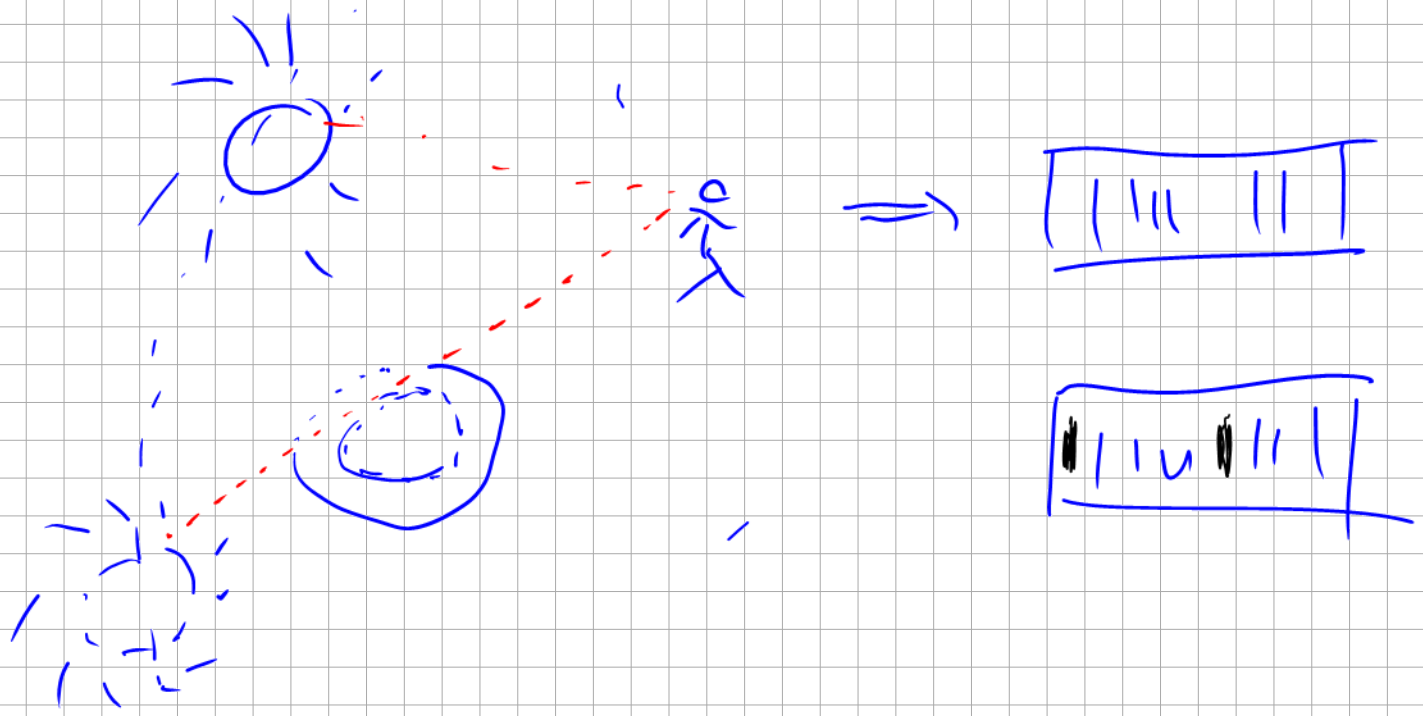
$$\sim \lambda = \frac{h \cdot c}{\Delta E}$$

$$= \frac{6.626 \cdot 10^{-34}\ Js \cdot 300\,000\,000\ m/s}{7.8 \cdot 10^{-19}\ J}$$

$$= 0.000\,000\,255\ m$$

$$= 2.55 \cdot 10^{-7}\ m \hat{=} 255\ nm$$

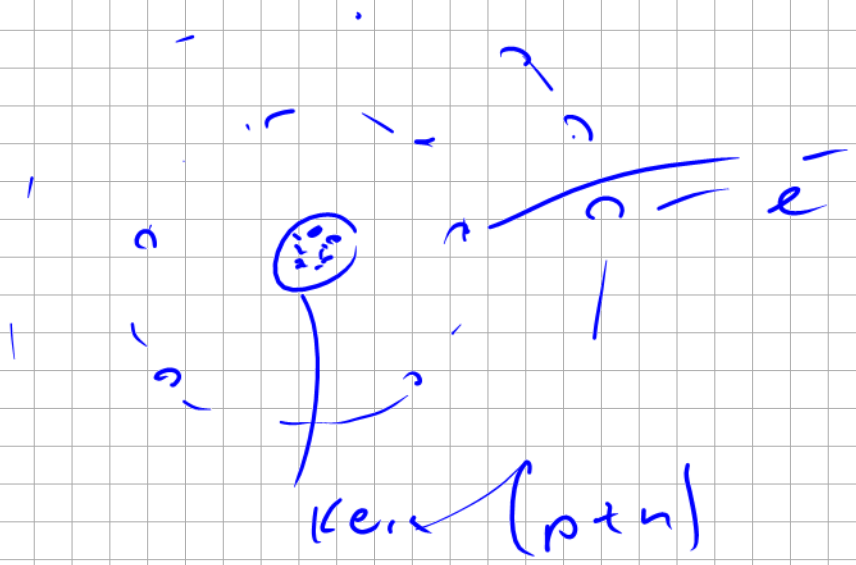
p. 66 - Doden → Emission / Absorption



- Zusammensetzung
- Dopplereffekt
  (Lichtquelle bewegt sich auf uns zu / weg)

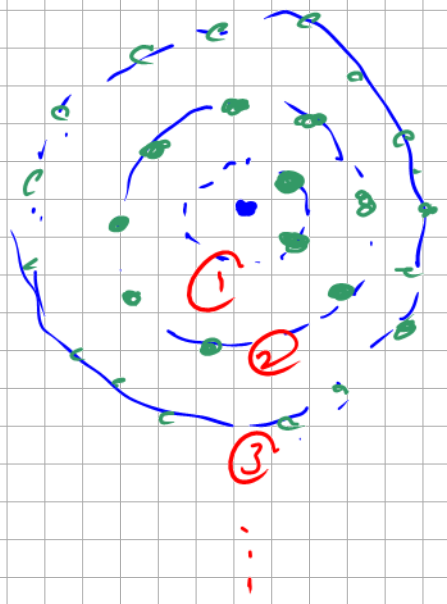
23.2.18

Frage ... wohin mit den e^- ?



- Anzahl e^- pro Schale ?
- e^- fallen in den Kern fallen !
  (p^+ e^- ziehen sich an)
- Heisenberg'sche Unschärferelation
  Unmöglichkeit, Gleichzeitig
  Ort + Geschwindigkeit messen
  zu können

Atomhüllenaufbau (nach Bohr)

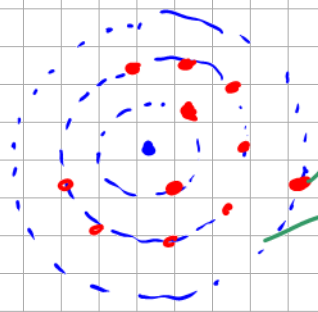


Schalennummer n	Anzahl e^- (maximal)
1	$2 = 2 \cdot 1^2$
2	$8 = 2 \cdot 2^2$
3	$18 = 2 \cdot 3^2$
n	$2 \cdot n^2$

Schale ≠ Orbital!

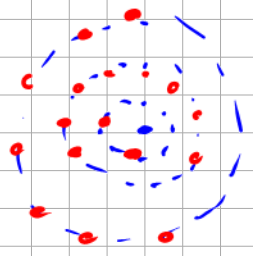
Bohrsches Atommodell von Natrium

↳ 11 Protonen
— 11 e^-



Valenzelektron
Valenzschale
} Anzahl Valenz-e^-: 1

Chloratom ... (17p, 17e^-)

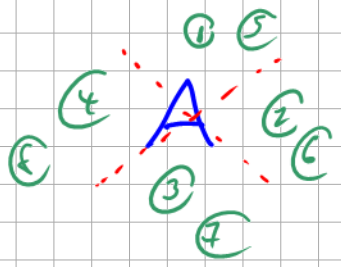


Anzahl Valenz-e^-: 7e^-

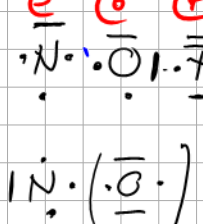
Schreibweise der Atome nach Lewis

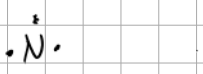
- Atome → Symbol Wasserstoff : H
  Sauerstoff : O etc.

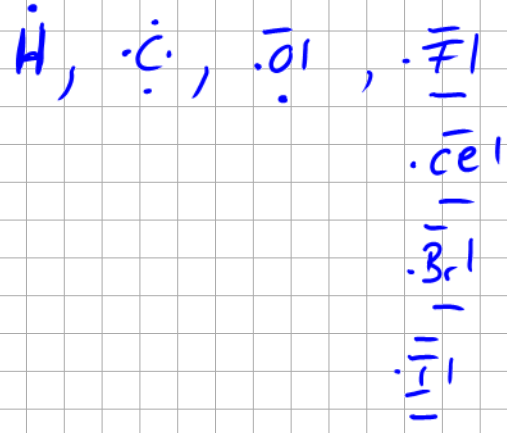
- Betrachtet werden nur die Valenzelektronen
- Folgende Symbolik: 1 $\bar{e}$: •
  2 $\bar{e}$: —
- Alle $\bar{e}$ werden in 4 Räume verteilt, pro Raum max. 2 $\bar{e}$



→ H, (Li), (Na), Be, B, C, N, O, F, Ne





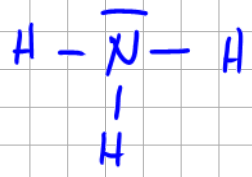
- 

Moleküle zeichnen

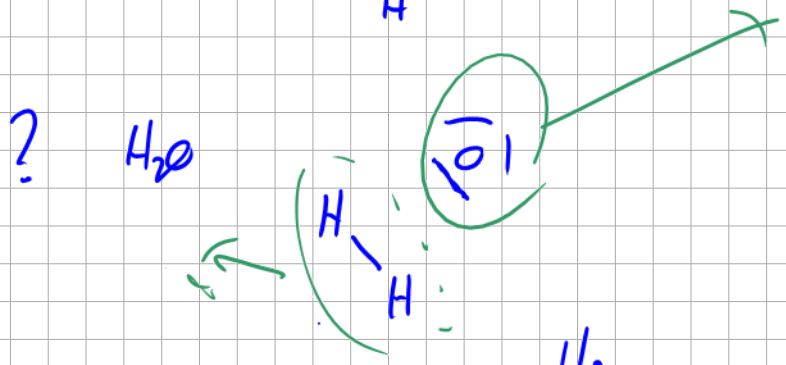
"eigentlich immer": Die Moleküle haben keine Punkte

zeichne Wasser mit dem Lewis-Modell, H_2O → d.h. 2 · H, 1 · O

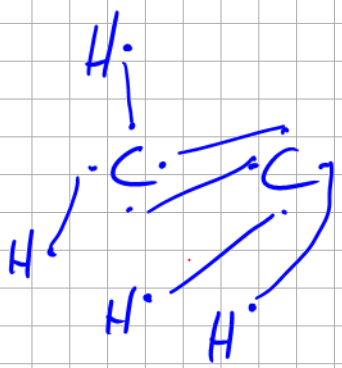
- NH_3

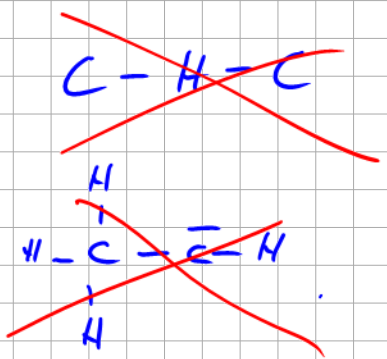


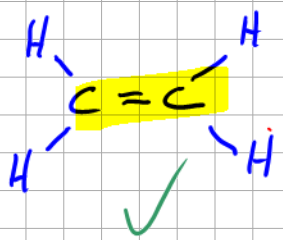
?

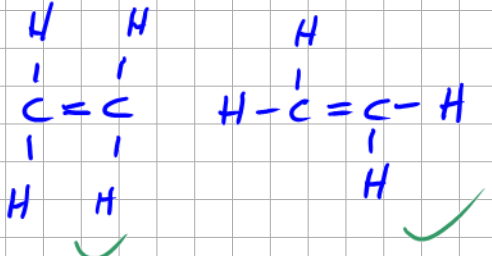


- C_2H_4



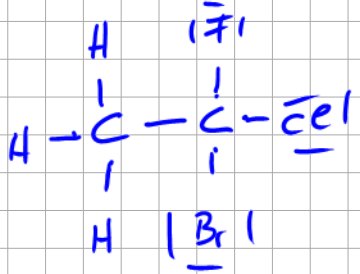


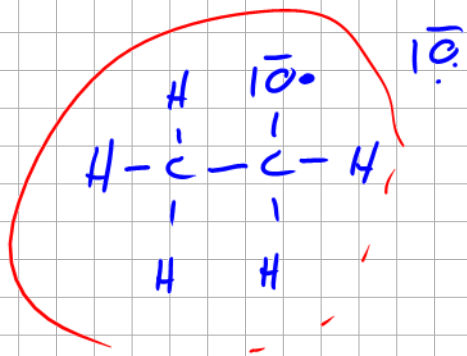




- C_2H_2

- Kohlenstoff mit einer Einfachbindung





Molekül mit einem ungepaarten e⁻ ("Punkt")

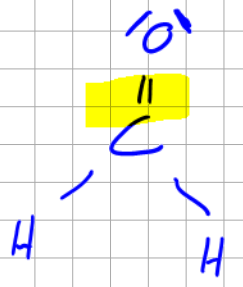
Radikal

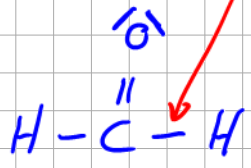
- HA CH_2O

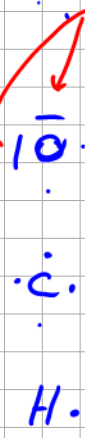
C_2H_6O

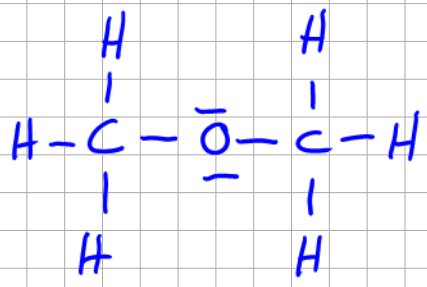
bindendes e⁻-Paar

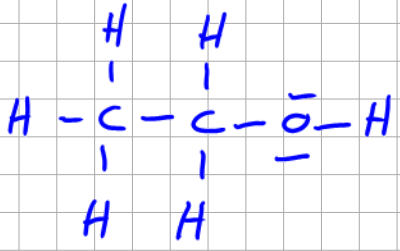
nicht bindende e⁻-Paare

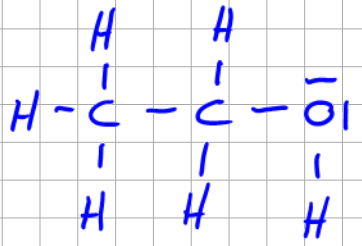






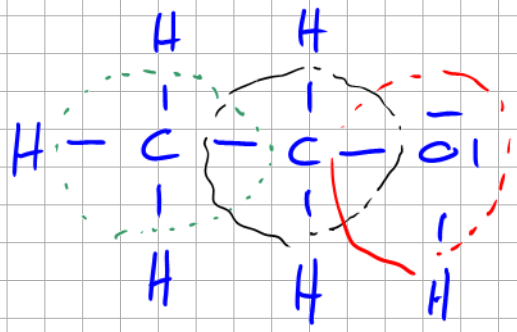


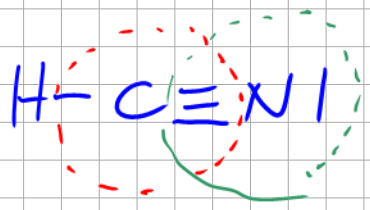




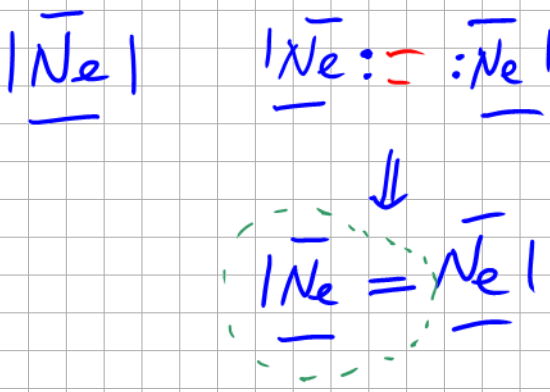
- N_2 $|N \cdot\cdot\cdot \cdot N|$ $\Rightarrow$ $|N \equiv N|$

- HCN $H \cdot\cdot\cdot \dot{C} \cdot\cdot\cdot \dot{N}|$ $\Rightarrow$ $H-C \equiv N|$

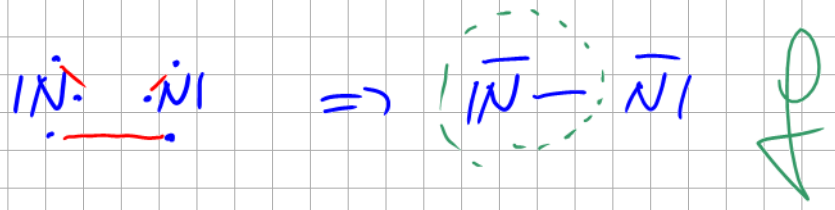




- Ne_2 ?!



- N_2

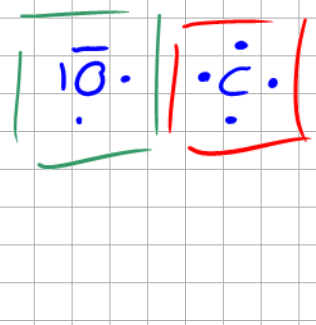


- C_2

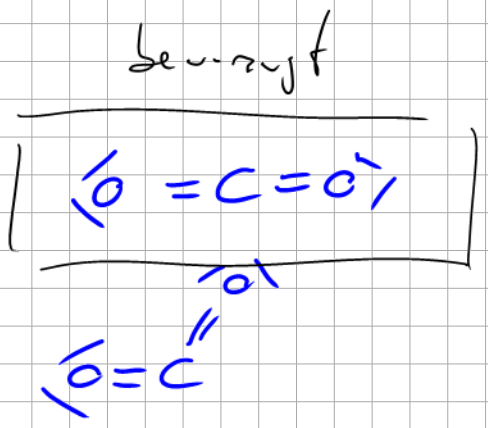
Geometrie (EPA: Elektronen-Paar-Abstoßungs-Theorie)

- Anordnung zweier Nachbaratome
- " dreier Nachbaratome → Zentralatom, Nachbaratome

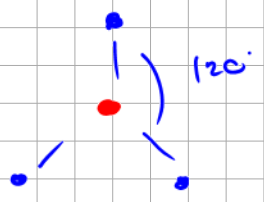
z.B. CO_2

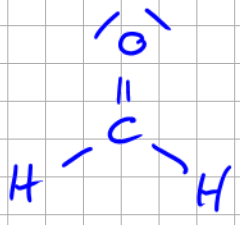


benutzt



- 4 Nachbarn → 1 Zentralatom
  3 Nachbaratome

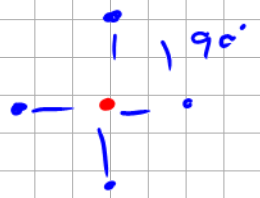


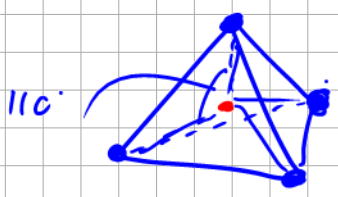


$\sphericalangle HCO = 120°$

$\sphericalangle HCH = 120°$

- 5 Nachbarn → 1 Zentralatom
  4 Nachbarn

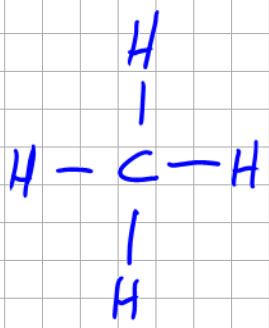


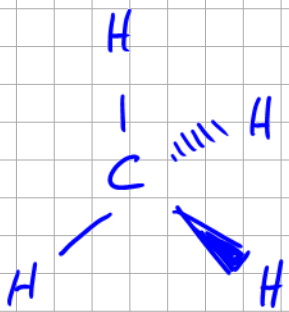


- im Zentrum des Tetraeders

$\sphericalangle 110°$

z.B. CH_4

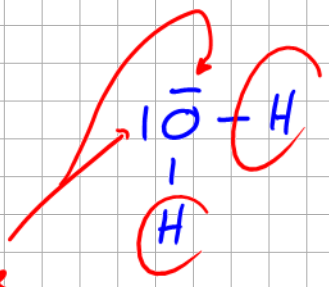




$\sphericalangle HCH = 110°$

- 2. Sept. 2018

Wasser, H_2O



2 wirkliche Nachbaratome

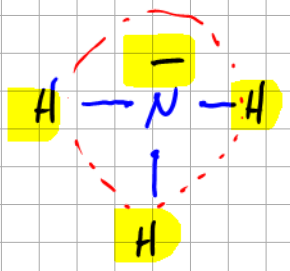
nicht bindende e⁻-Paare

⇒ "2 Nachbarn" ⇒ ein Zentralatom und tetr.

4 Nachbarn:

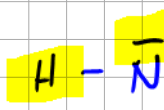
- $\sphericalangle HOH = 110°$ (!)

- NH_3, $\sphericalangle HNH$

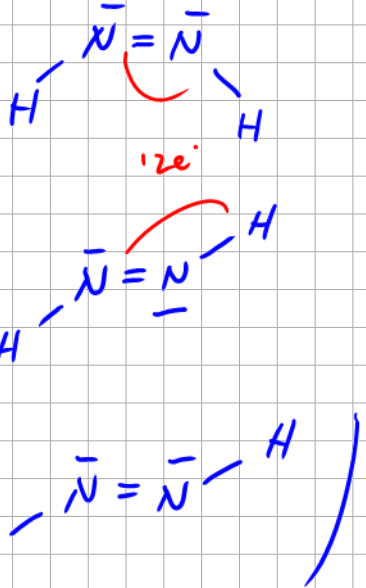


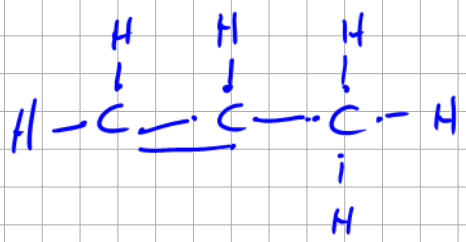
4 Nachbarn → 110°

N_2H_2, C_3H_7, CH_4O, H_2O_2, C_2H_2

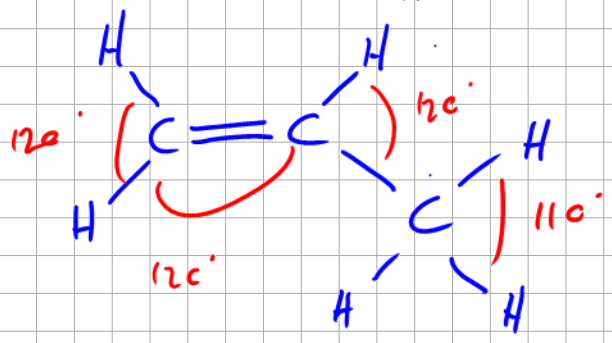


↳ 3 Nachbarn → 120°

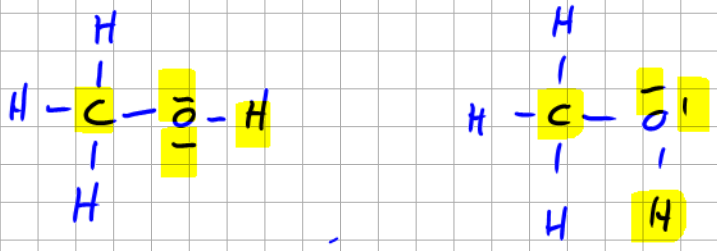




C_3H_6 ... $\neq C_3H_7$!



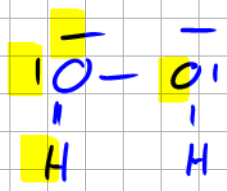
CH_4O



$\sphericalangle COH = 110°$

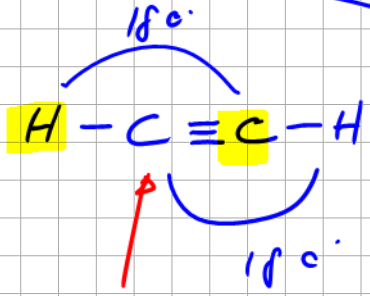
$\sphericalangle HCH = 110°$

H_2O_2

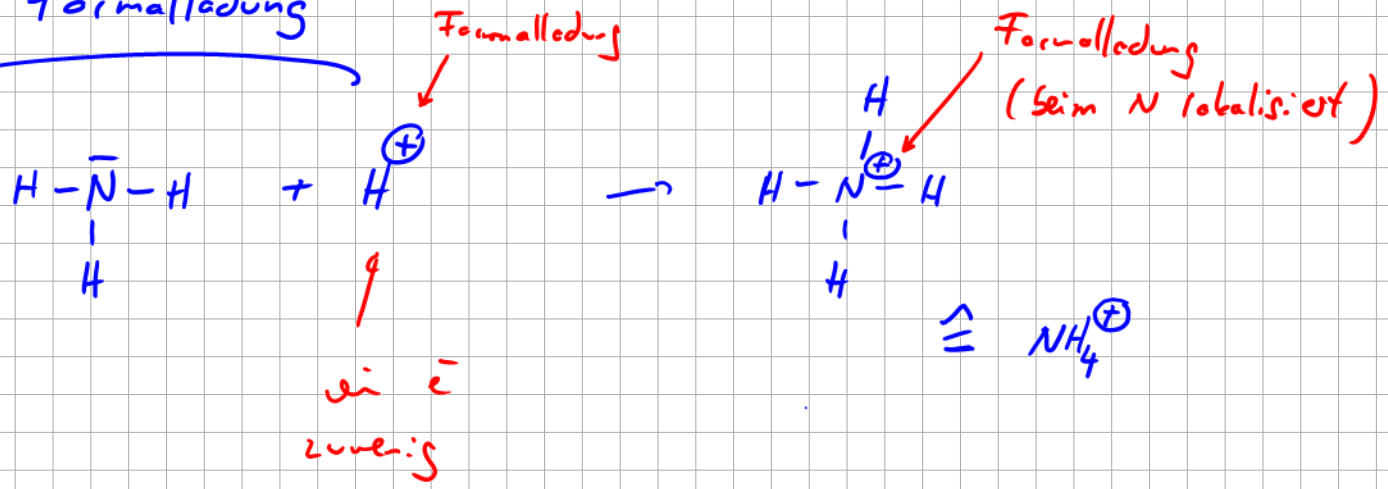


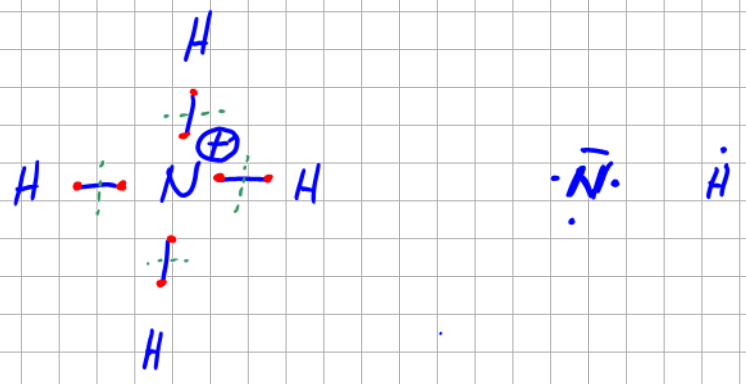
$\sphericalangle HOO = 110°$

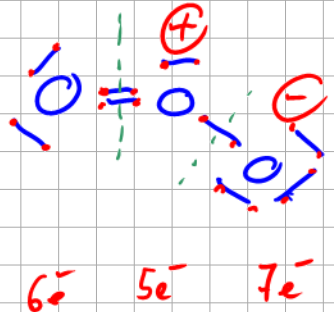
C_2H_2



Formalladung



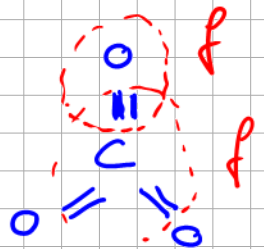


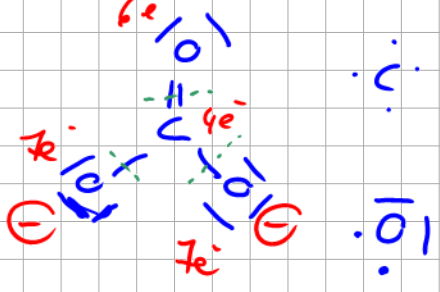


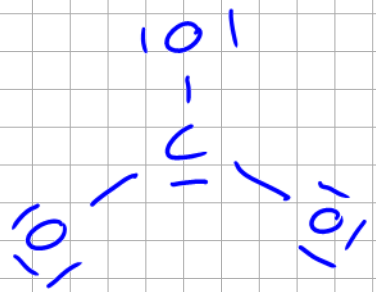
(= Ozon)

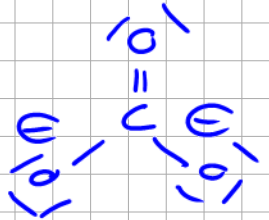
O_3

- CO_3^{2-} (Carbonat)





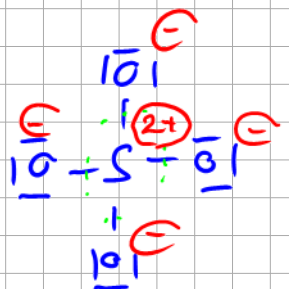


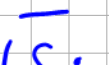


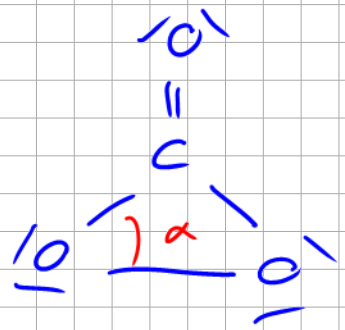
(≙ CO_3^{2-})

: Formalladung

- SO_4^{2-} (Sulfat)
  - ckte H
  - $\not{4}$
  - Formalladung

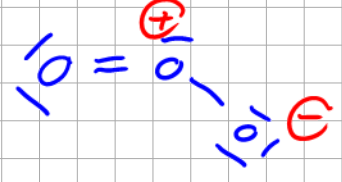




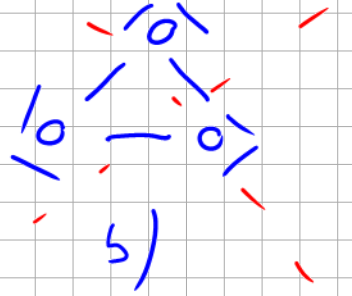
- 

?! $\alpha \sim 60°$

EPA: $110°$

- O_3 

a)



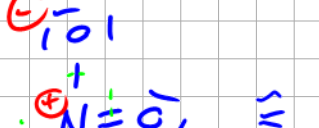
b)

- HNO_3 (Salpetersäure)

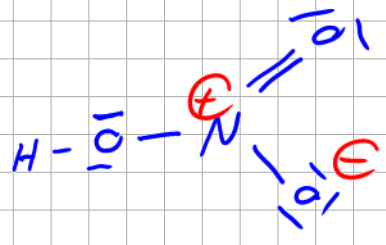
$\hat{=} HNO_3^{2-}$

$\not\sphericalangle ONO = 120°$

$\not\sphericalangle HON = 110°$

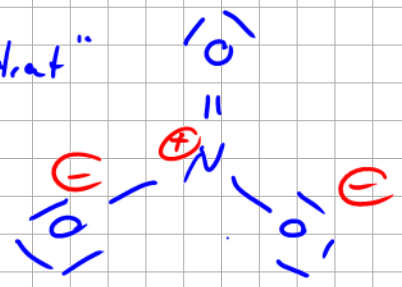


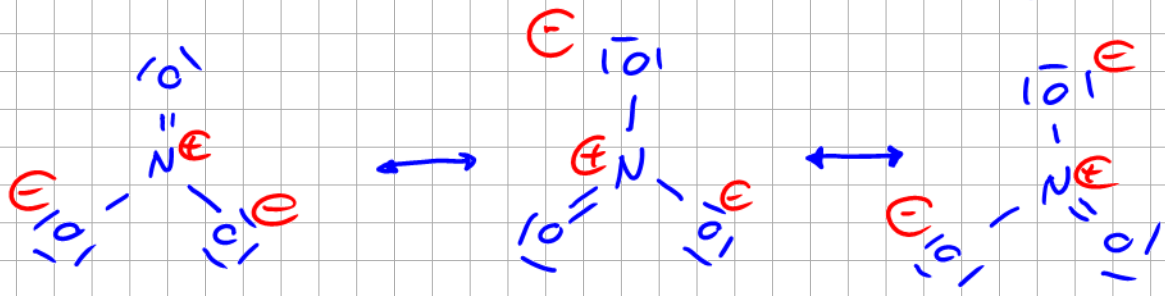
$\hat{=} HNO_3$ / :



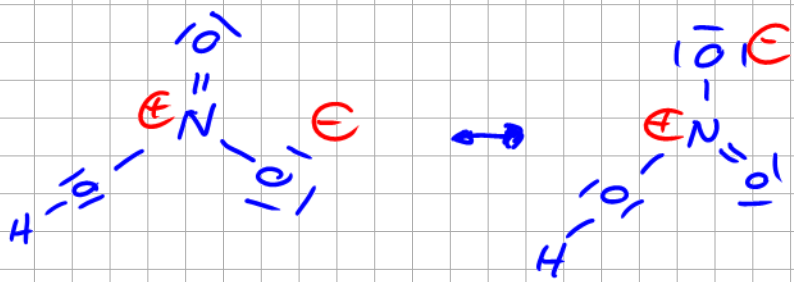
HNO_3 : Säure (Definition) H^+ – Spender

"Nitrat"

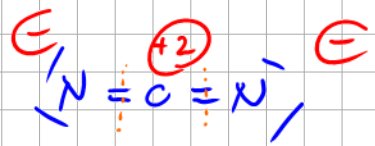




"Mesomerie"



N_2O



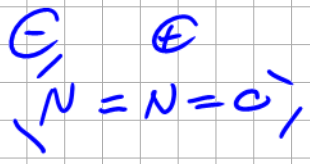
"kein permanenter Dipol vorhanden"

"Untersuchungen zeigen, dass das Molekül N_2O einen permanenten Dipol hat d.h. die Ladungsschwerpunkte heben sich nicht auf (wie bei Molekül N–O–N)

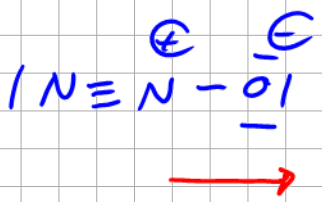
⇒ Die Atome sind anders verknüpft

N–N–O

z.B.



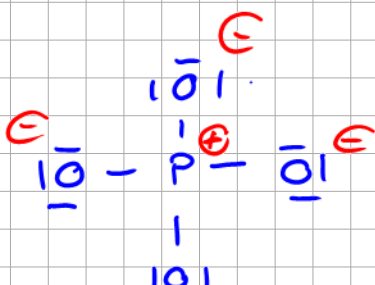
Permanenter Dipol? ja

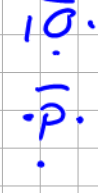


"

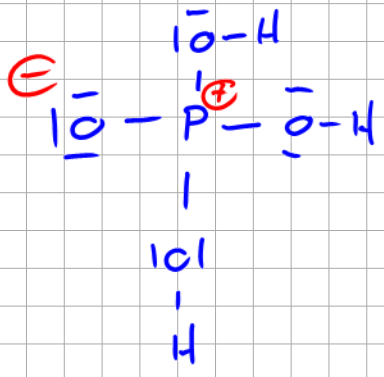
"Phosphat" ⋯→ Phosphorsäure ("H_3PO_4")

$H_3PO_4 \xrightarrow{-H^+} H_2PO_4^- \xrightarrow{-H^+} HPO_4^{2-} \xrightarrow{-H^+} PO_4^{3-}$



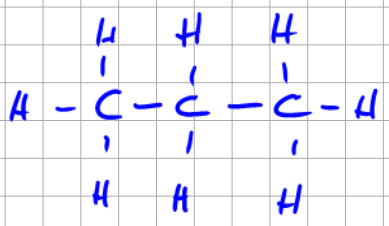


$\hat{=} PO_4^{3-}$



Skelettformel (p. 292)

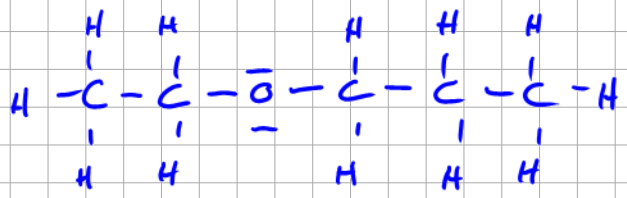
("C + H - Atome nicht immer zeichnen")



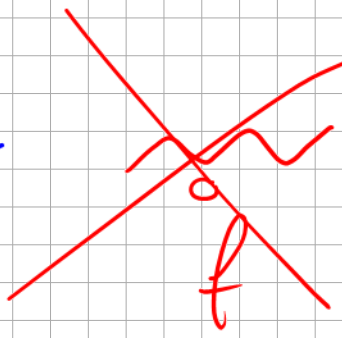
→ 

· C-Atom

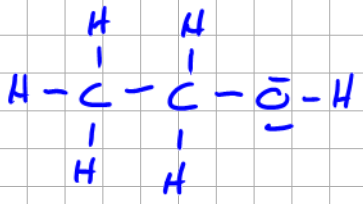
(C_3H_8 : Summenformel)



→ 



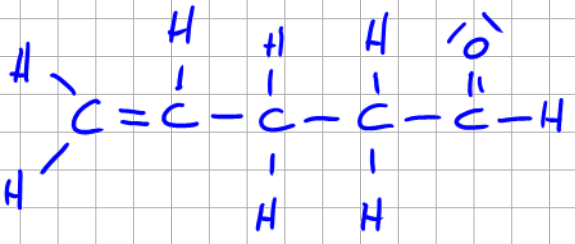
($C_5H_{12}O$)

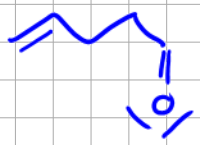


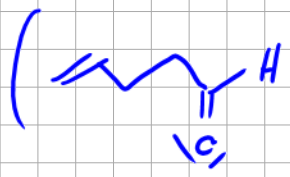
→ 

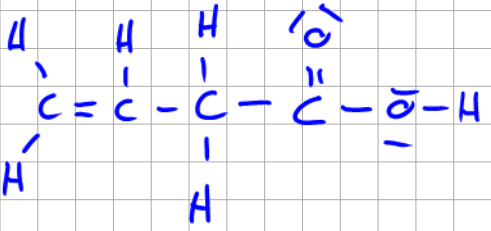
(auch )

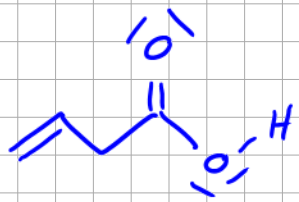
C_2H_6O





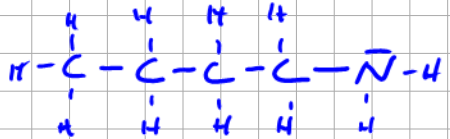






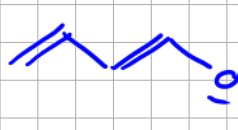
- 

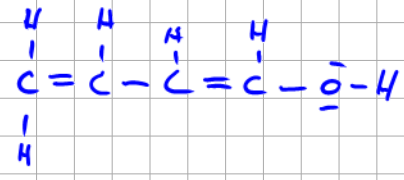
Lewisschreibese ?



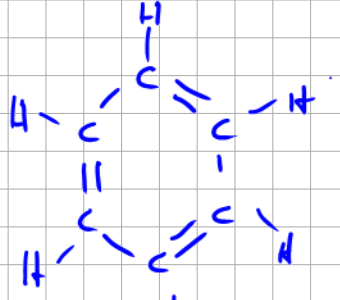
Summenformel

$C_4H_{11}N$

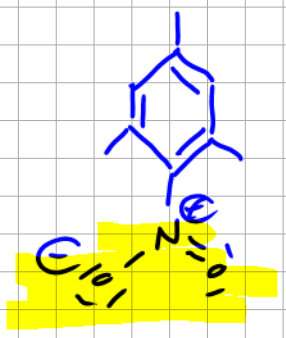


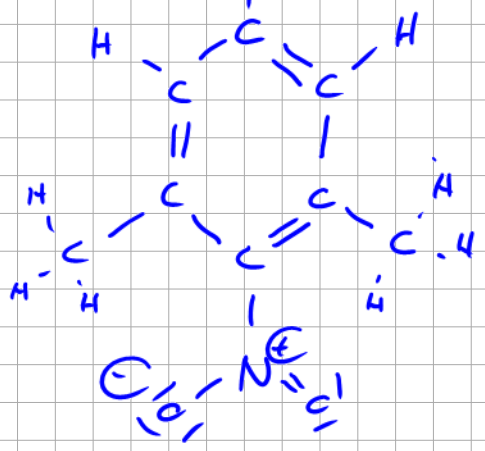


C_4H_6O

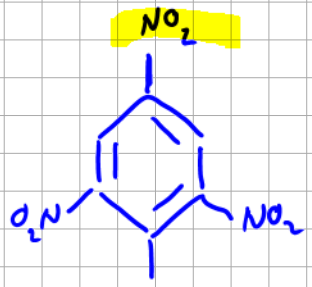


C_6H_6





$C_9H_{11}NO_2$



$C_7H_5NO_6$ Summenformel.

Molmasse !

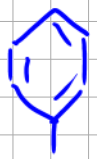
$M(C_7H_5N_3O_6) = 7 \cdot 12 + 5 \cdot 1 + 3 \cdot 14 + 6 \cdot 16$

$= 84 + 5 + 42 + 96$

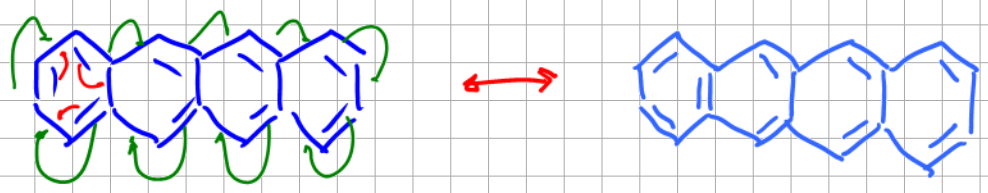
$= 227\ g/mol$

TNT

Tri - Nitro - Toluol



Kohlenstoff - Modifikationen



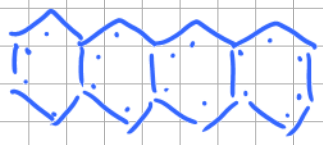
Graphit

"leichte Verschiebbarkeit von Elektronen"

↕

elektrische Leitfähigkeit ("Strom")

Diamant



Fußballförmige Struktur: Fullerene

(p. 106 / 107 ...)