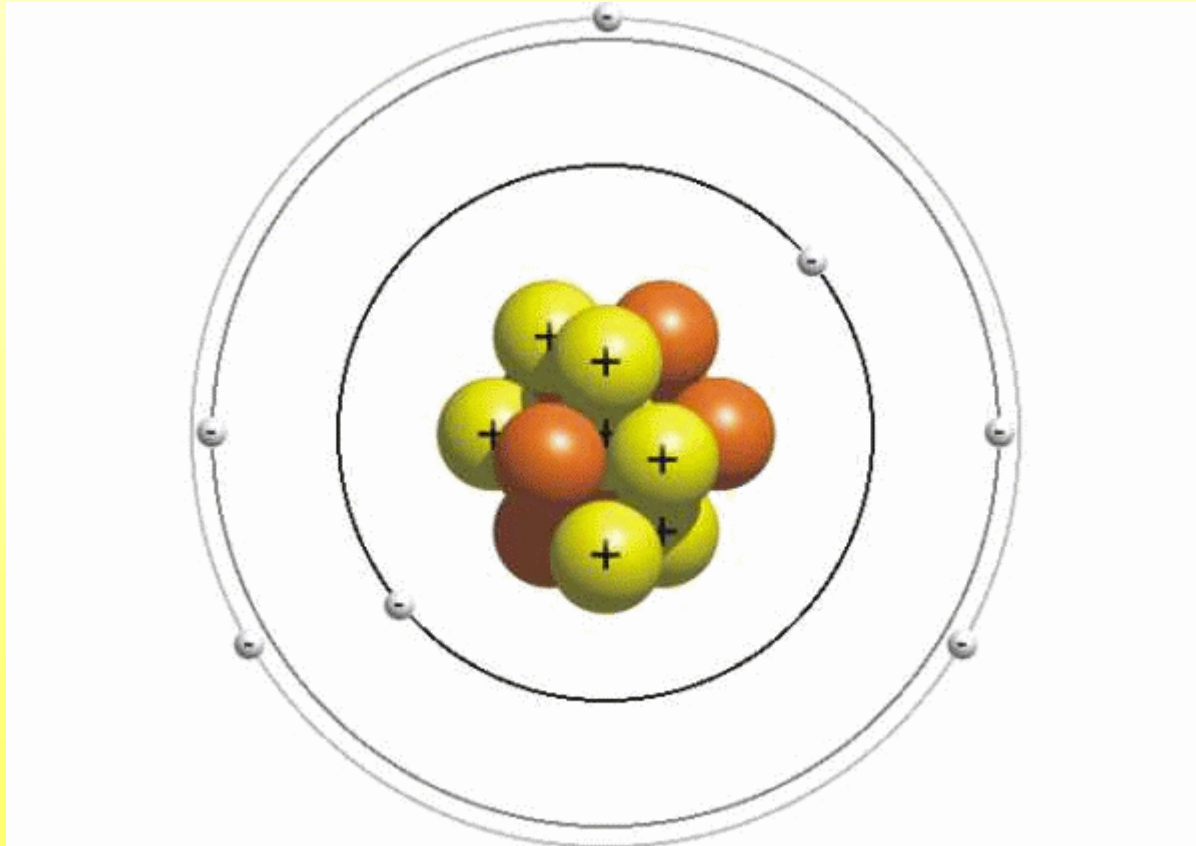
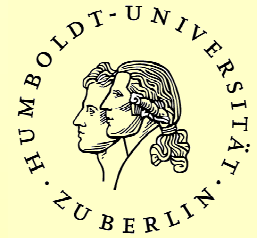
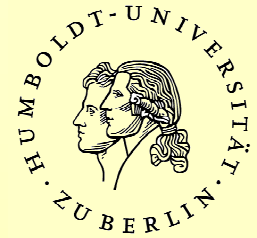


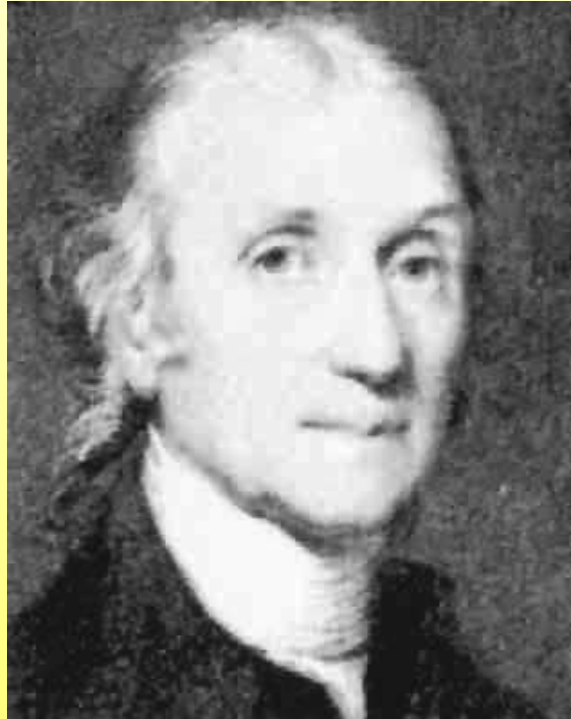
# Stickstoff – träge und explosiv



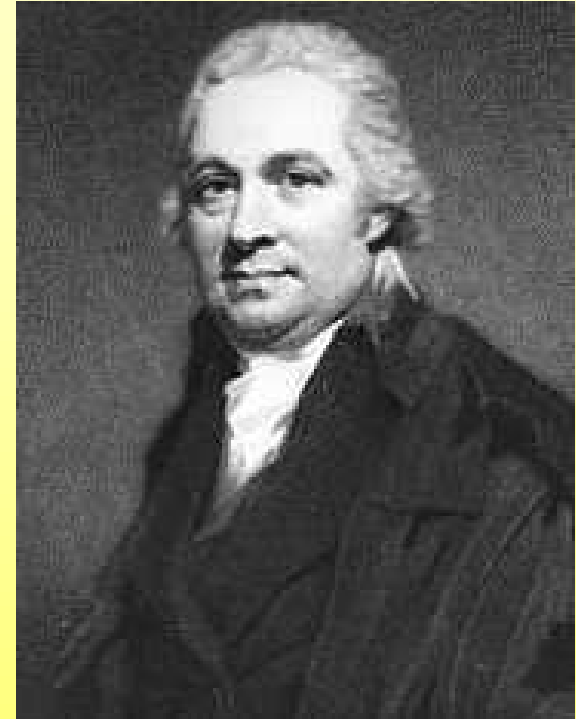
# Entdeckung des Stickstoffs



Carl Scheele

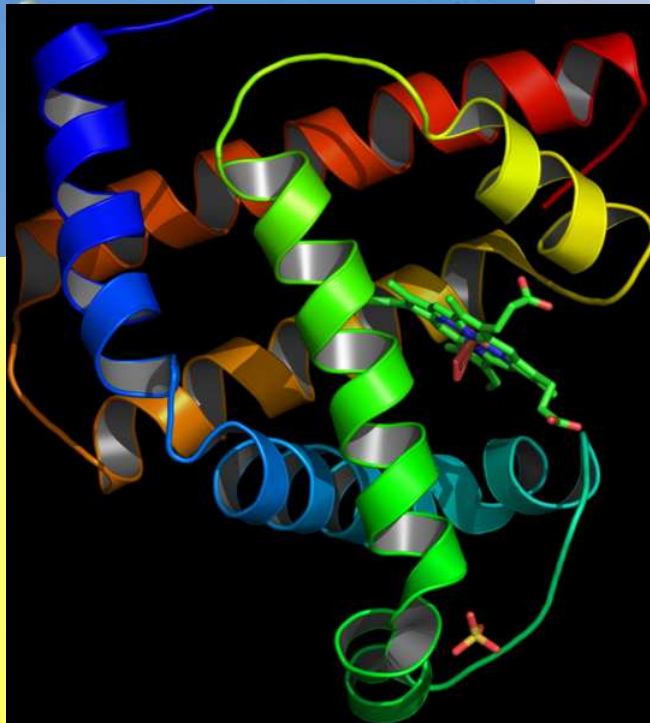
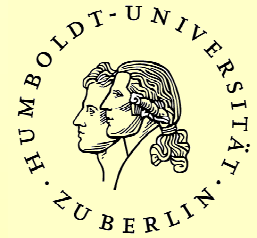


Henry Cavendish



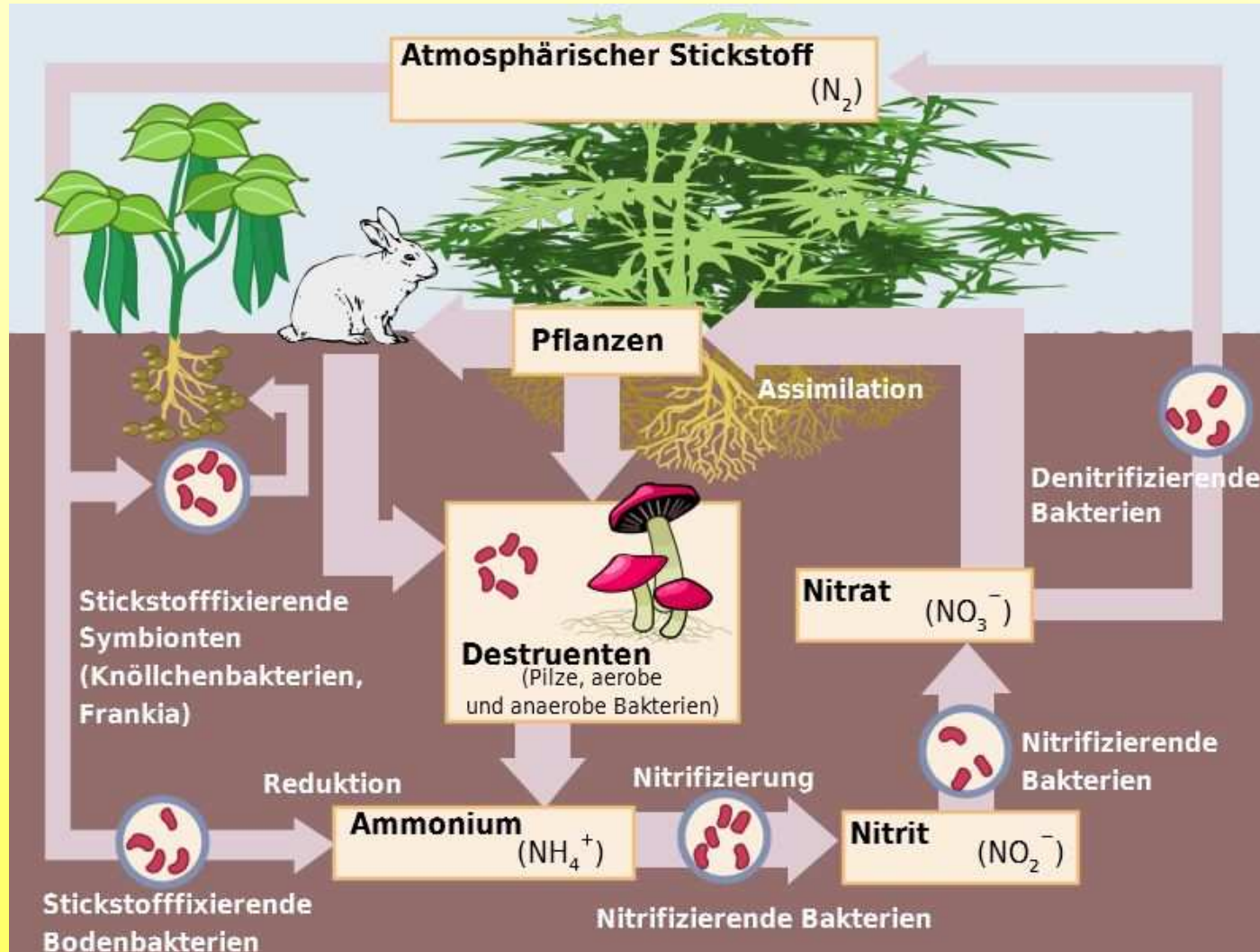
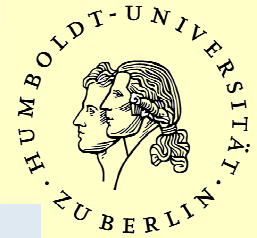
Daniel Rutherford

# Vorkommen von Stickstoff

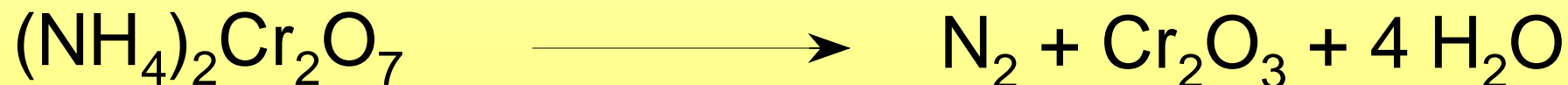


- Elementar: Luft
- Mineralisch: Salpeter
- Organisch: Eiweiße

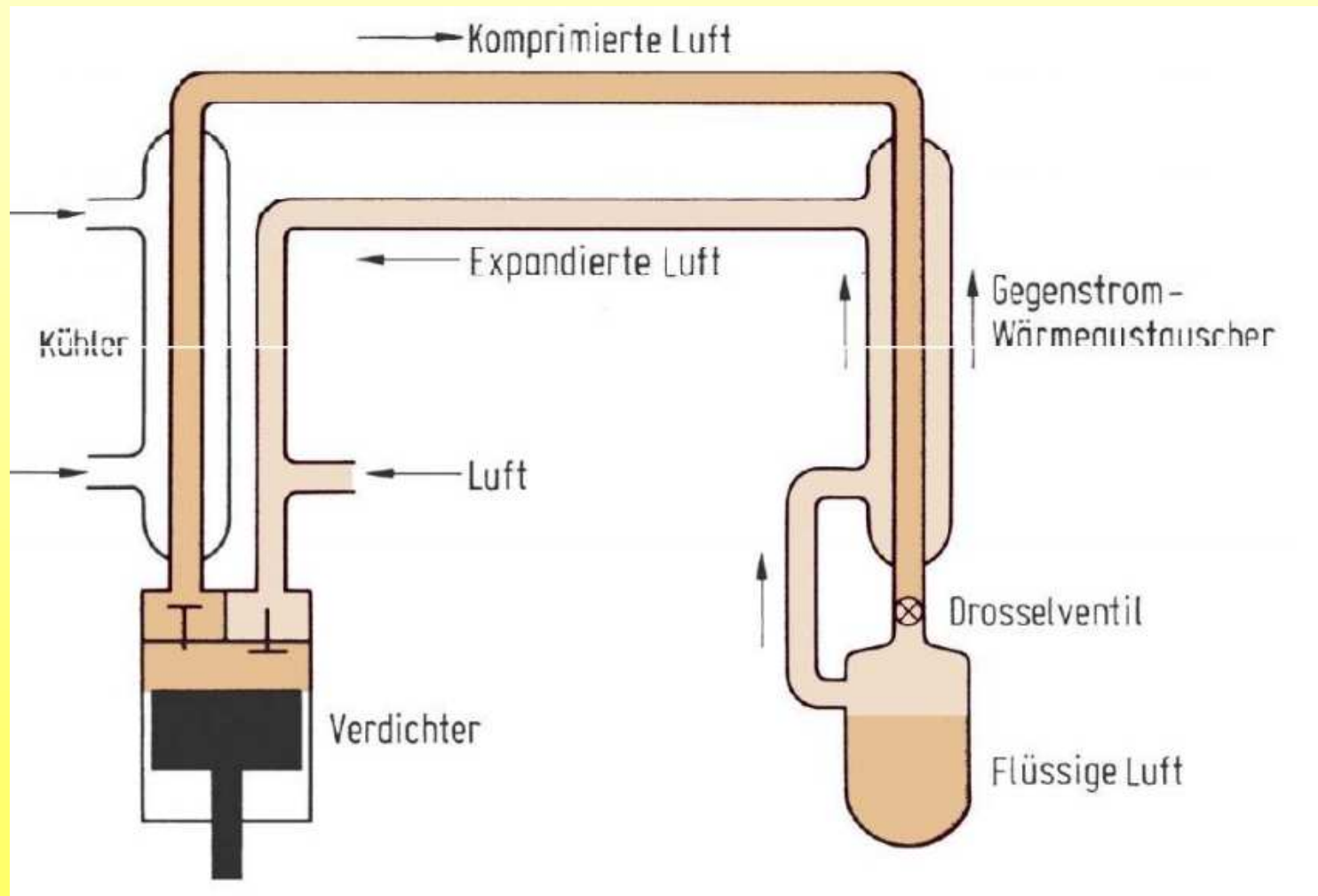
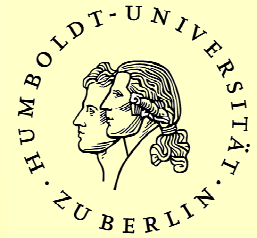
# Stickstoffkreislauf in der Natur



# Darstellung von Stickstoff im Labor



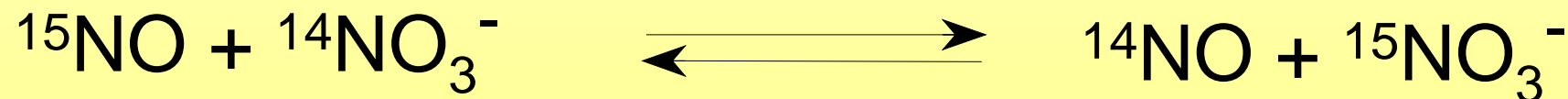
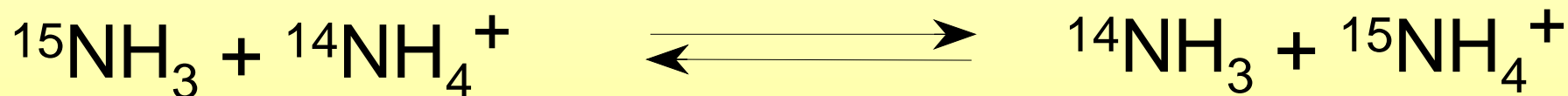
# Technische Darstellung von Stickstoff: Luftverflüssigung



# Eigenschaften von Stickstoff

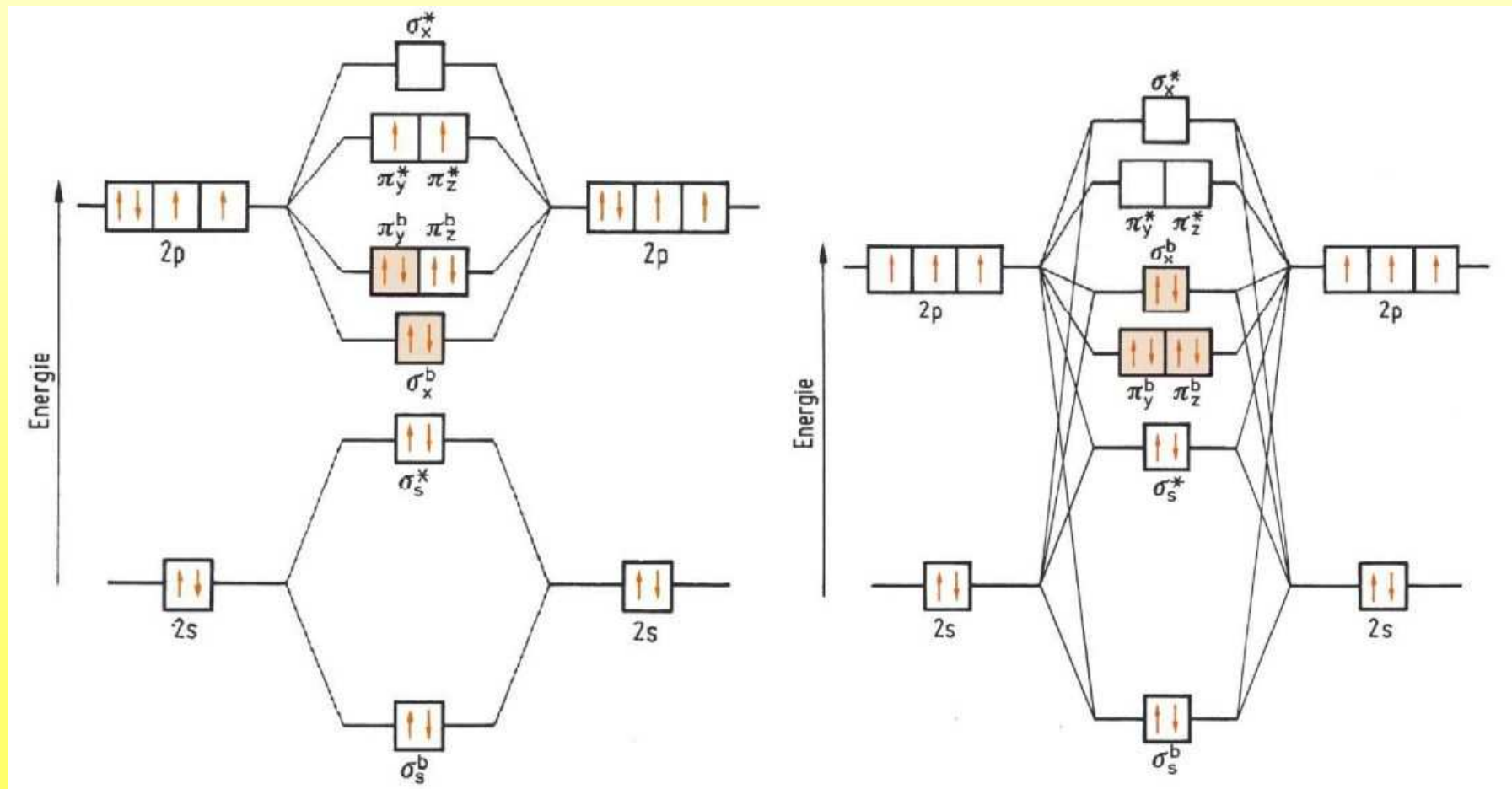
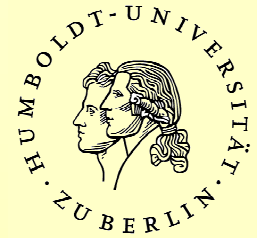


- $M = 14,0067$
- 2 stabile Isotope:  $^{14}\text{N}$ : 99,634%;  $^{15}\text{N}$ : 0,366%

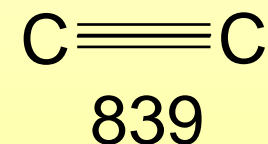
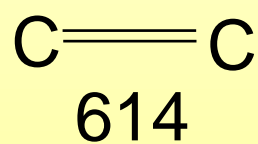
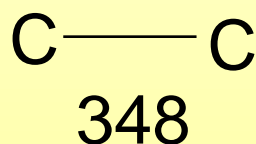
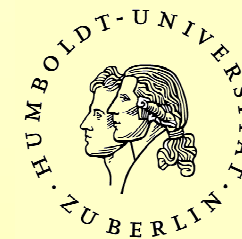


- Farblos, geruchlos
- Schmelzpunkt  $-210\text{ }^\circ\text{C}$ , Siedepunkt  $-196\text{ }^\circ\text{C}$
- Diamagnetisch
- Bindungsenergie  $945\text{ kJ/mol}$  ( $\text{O}_2$ :  $498\text{ kJ/mol}$ )
- Bindungslänge  $110\text{ pm}$  ( $\text{O}_2$ :  $121\text{ pm}$ )

# Elementarer Stickstoff ist sehr reaktionsträge

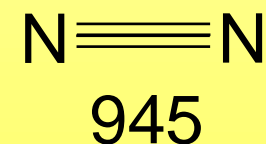
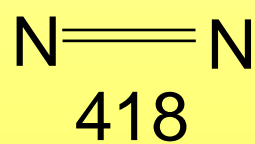


# Bindungsenergien in Stickstoff-Stickstoff-Bindungen



266

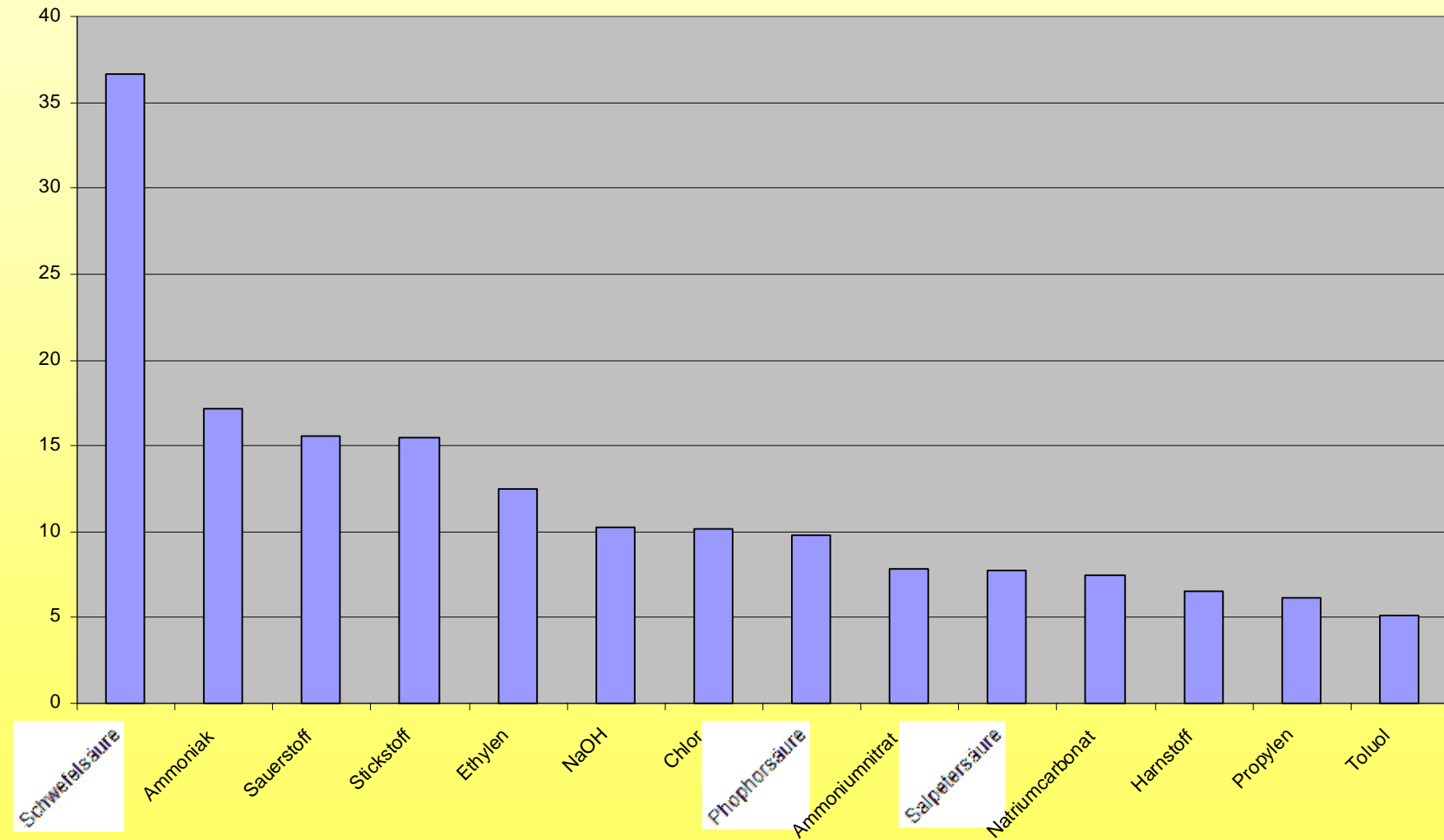
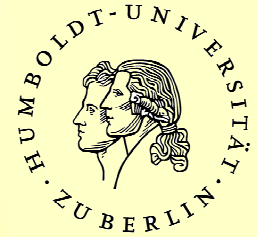
225



255

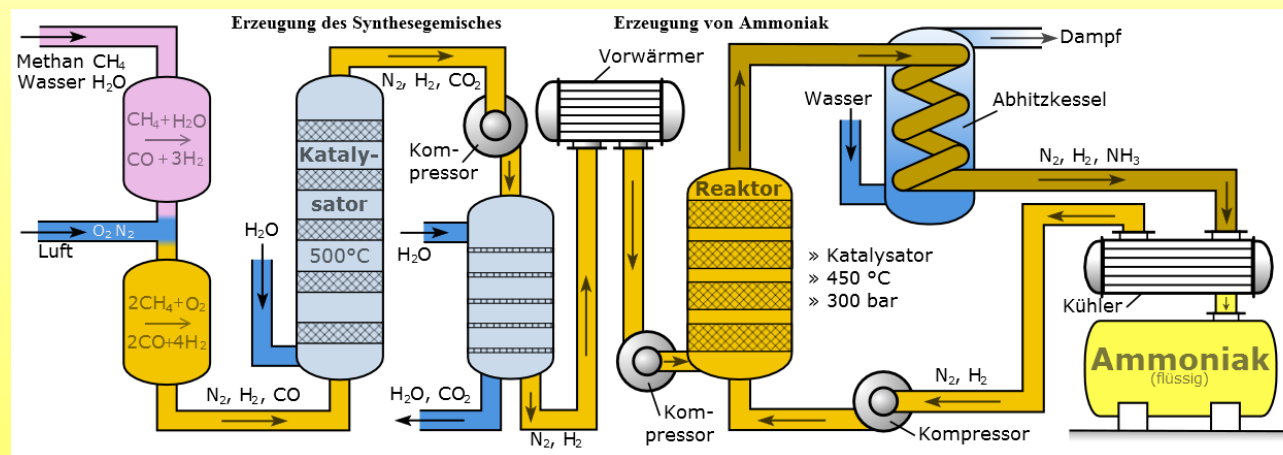
527

# Produktion wichtiger Industriechemikalien, USA, 1980, (Mio t)



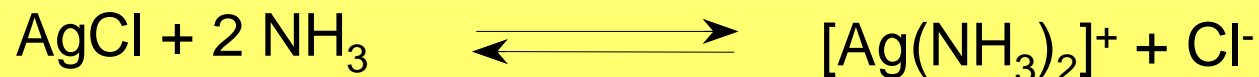
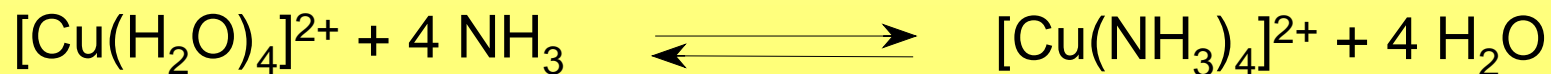
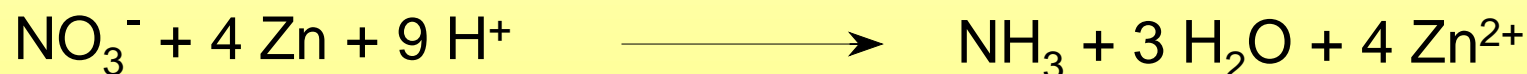
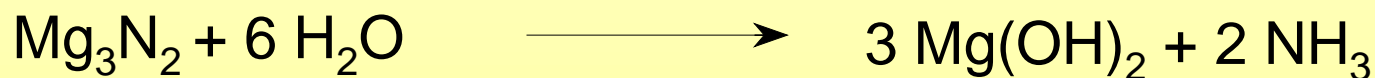
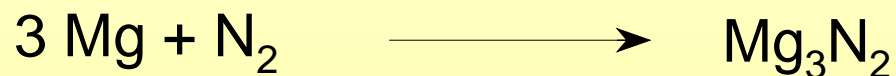
# Die Nr. 1: Ammoniak

- Fp  $-78\text{ }^{\circ}\text{C}$
- Kp  $-33\text{ }^{\circ}\text{C}$
- Herstellung durch Haber-Bosch-Verfahren

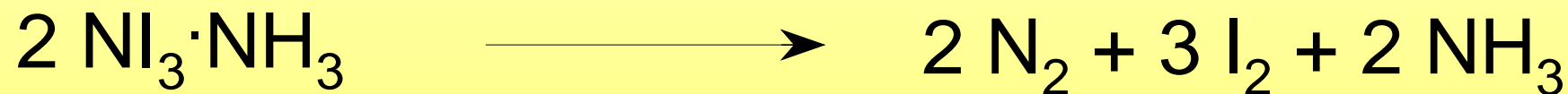
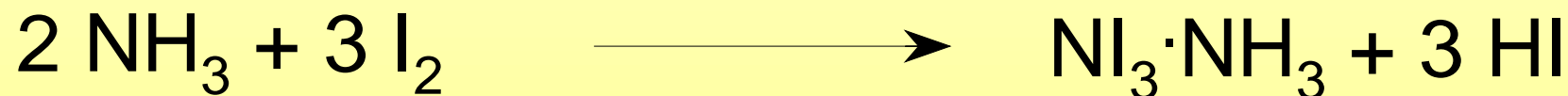


- $1\text{ l H}_2\text{O (l)}$  löst  $700\text{ l NH}_3\text{ (g)}$
- Basische Reaktion in Wasser:  $\text{pK}_b = 4,75$

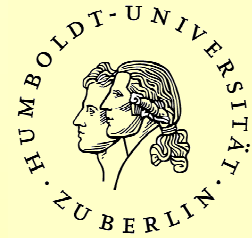
# Ammoniak – Darstellung, Nachweis, Komplexbildung



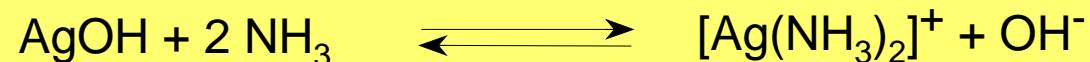
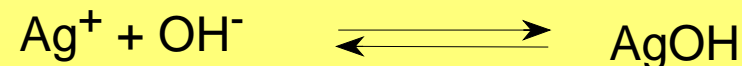
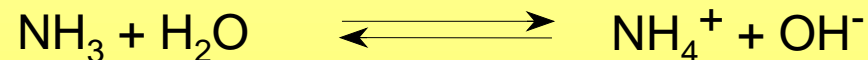
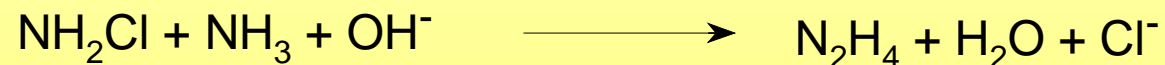
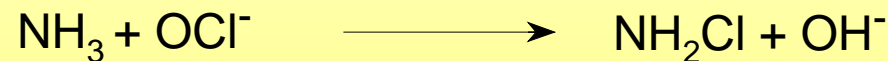
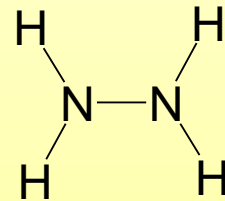
# Stickstoff-Halogen- Verbindungen: Iodstickstoff



# Hydrazin – Darstellung und Eigenschaften



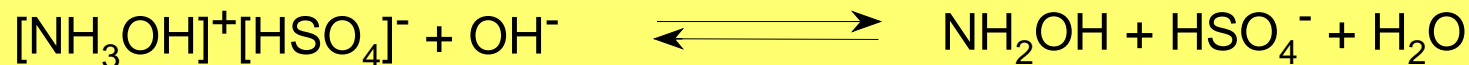
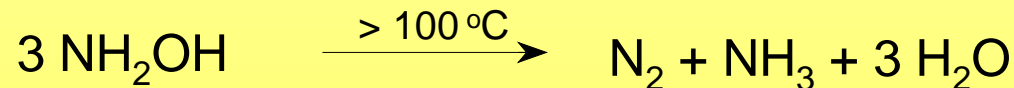
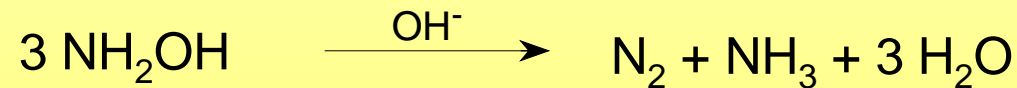
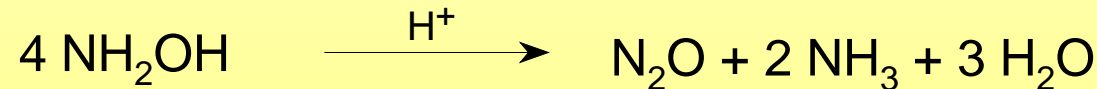
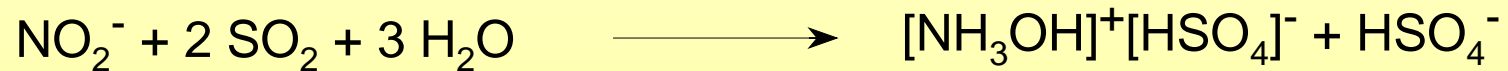
Raschig-Verfahren



# Hydroxylamin: Sauer und basisch?



$$pK_B = 8,2 \quad pK_S = 13,7$$



# Stickstoff – träge und explosiv

