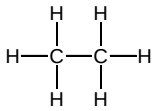
INTRODUKTION TILL ORGANISK KEMI

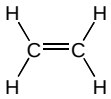
KARBONYLGRUPPSKEMI

Föreläsning v16 Nina Kann

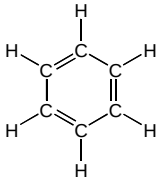
Olika typer av kolväten

- alifatiska
  - alkaner
  - alkener
  - alkyner

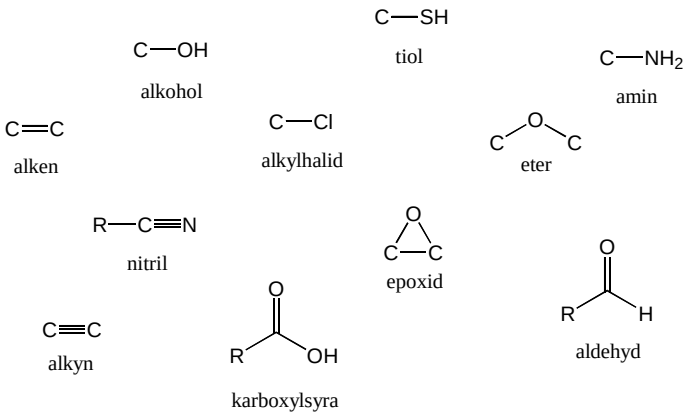




- aromatiska



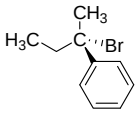
Funktionella grupper

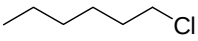


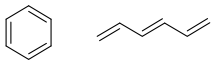
En funktionell grupp är den enhet i en molekyl som ger upphov till molekylens reaktivitet.

Organisk kemi i denna kurs

- v16 karbonylgruppens kemi
  C=O
- v17 alkylhaliders reaktivitiet, kiralitet
- v18 alkener, karbokatjoner, konformationer
  C=C
- v19 aromaticitet och konjugering
- v20 aromatiska molekylers reaktivitet, organisk syntes







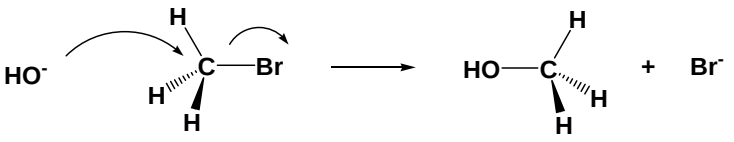
Nukleofiler/elektrofiler

5

- En *nukleofil* söker sig till något positivt. En nukleofil kan vara antingen en anjon eller en neutral molekyl med minst ett fritt elektronpar.
- En *elektrofil* söker sig till något negativt. En elektrofil kan vara en katjon (t.ex. H^+) eller en positivt polariserad atom, t.ex. karbonyl (C=O).

Användning av pilar

- Pilarna visar hur **elektronerna** rör sig (ej atomernas rörelse):



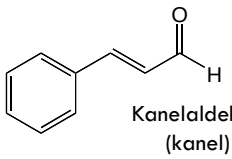
Karbonylgruppens kemi

Aldehyder, ketoner och karboxylsyraderivat

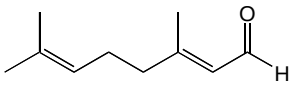
Klasser av molekyler som innehåller C=O

- Aldehyder
- Ketoner
- Karboxylsyror
- Estrar
- Amider
- Syraklorider
- Syra anhydrider

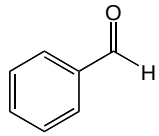
Aldehyder



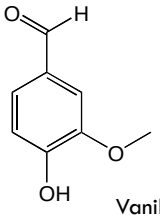
Kanelaldehyd
(kanel)



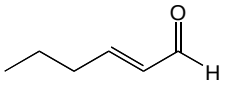
Citral
(citrongräs)



Bensaldehyd
(bittermandel)

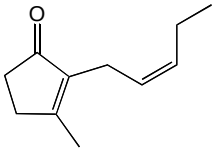


Vanillin
(vaniljstång))

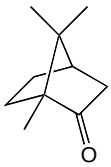


trans-2-Hexenal
(alarmferomon för
en typ av myror)

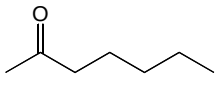
Ketoner



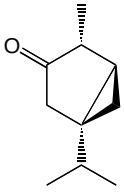
Jasmon
(jasminblomma)



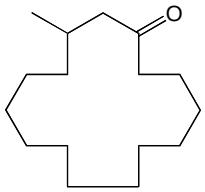
Kamfer
(eucalyptus)



2-Heptanon
(alarmferomon för bin)

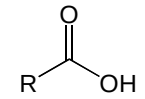


Thujon
(absint)

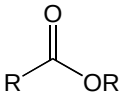


Muskon
(myskhjort)

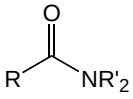
Karboxylsyraderivat



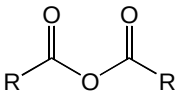
karboxylsyra



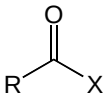
ester



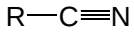
amid



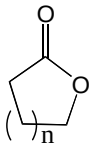
syraanhydrid



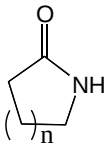
syraklorid



nitril

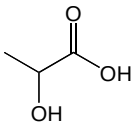


lakton

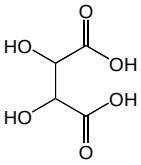


laktam

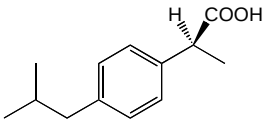
Karboxylsyror



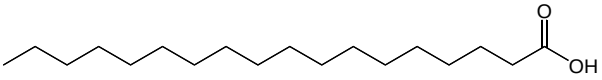
Mjölksyra



Vinsyra



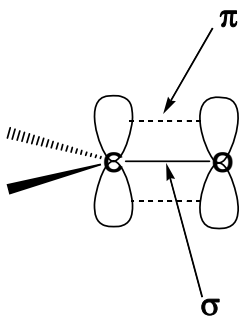
Ibuprofen



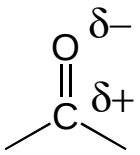
Stearinsyra

Karbonylgruppen C=O

- plan, 120°
- sp^2-hybridisering på både C och O
- π-bindning & σ-bindning



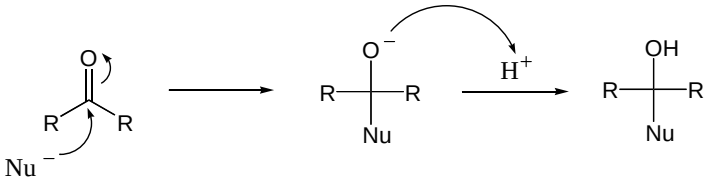
Karbonylgruppen är polär



- Kolet reagerar med nukleofiler
- Syret reagerar med elektrofiler (ofta H^+)

Nukleofil addition till C=O

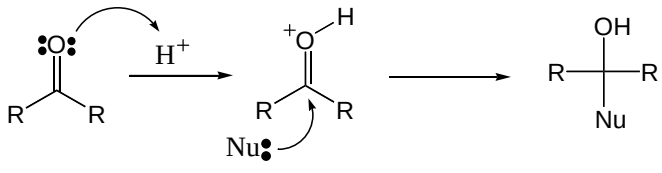
- Mekanism



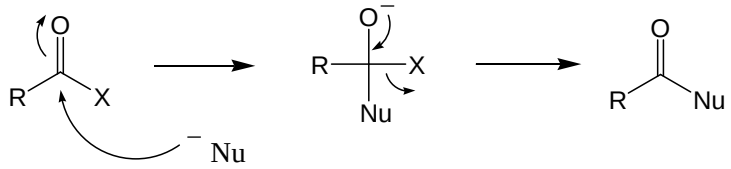
- Nukleofilen kan vara en anjon (Nu^-) eller neutral (Nu:)
- Elektrofilen är vanligtvis H^+.

Nukleofil addition till C=O

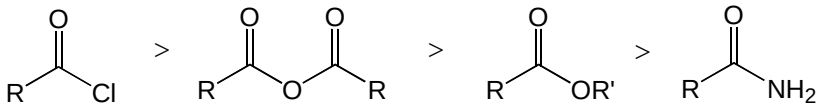
- Om nukleofilen är svag behöver karbonylgruppen aktiveras med syra.



Nukleofil substitution vid C=O

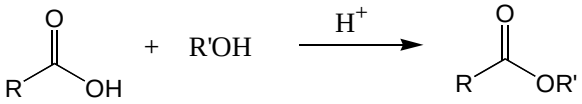


Reaktivitet

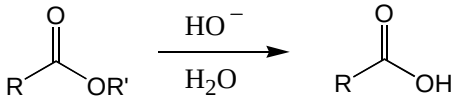


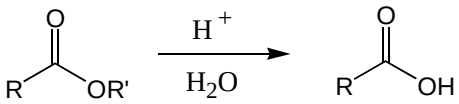
- Ett mer reaktivt karboxylsyraderivat kan användas för att framställa ett mindre reaktivt derivat (men ej tvärtom).

Förestring (estersyntes)



Esterhydrolys, basisk eller sur





Oxidation & reduktion

Oxidationsnivå

- Karboxylsyror /estrar / amider

  ↑ oxidation

- Aldehyder / ketoner

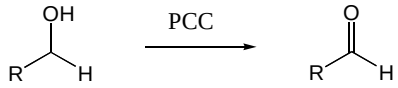
  ↑ oxidation

- Alkoholer

Tertiära alkoholer oxideras ej.

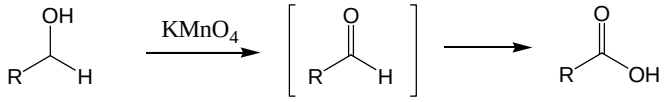
Oxidation av alkoholer till aldehyd

- Alkoholer kan oxideras till aldehyder m.h.a. PCC



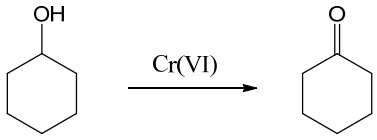
PCC = pyridinium klorokromat

De flesta andra oxidationsreagens tenderar att ge oxidation hela vägen till karboxylsyra.



Oxidation av alkohol till keton

- Oxidation till keton mindre känsligt för val av oxidationsmedel.

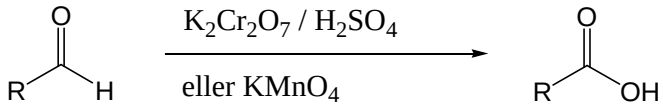


Cr(VI):
CrO_3, $Na_2Cr_2O_7$, PCC

Oxidation av aldehyder

25

- Aldehyder kan oxideras till karboxylsyror

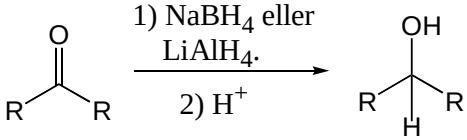


- Ketoner oxideras ej

Reduktion av aldehyder/ketoner

26

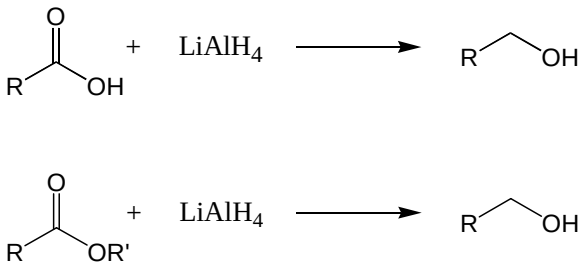
- Reduktion med hydrid (Nu = "H^-" i form av $NaBH_4$ eller $LiAlH_4$)



Mekanism: nukleofil addition av hydrid (dvs. H^-) till karbonylgruppen

Reduktion av karboxylsyror/estrar

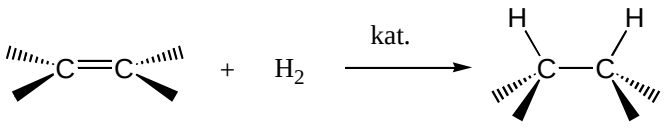
- $LiAlH_4$ krävs i detta fall ($NaBH_4$ är för svagt reduktionsmedel).



Reduktion av C=C

28

Addition av H_2 i närvaro av metall ger reduktion av en dubbelbindning; kallas katalytisk hydrogenering.



syn addition

Katalysatorn är vanligtvis Pd, Pt eller PtO_2