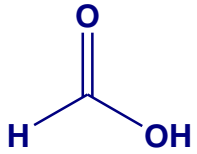
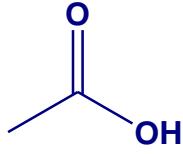


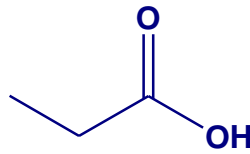
Kwasy karboksylowe



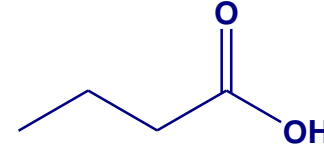
kwasy metanowy
kwasy mrowkowy



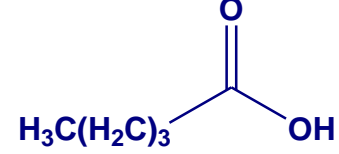
kwasy etanowy
kwasy octowy



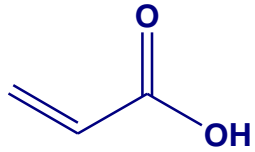
kwasy propionowy
kwasy etanokarboksylowy



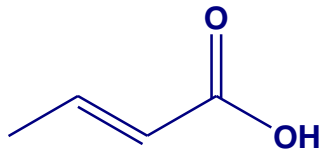
kwasy butanowy
kwasy masłowy



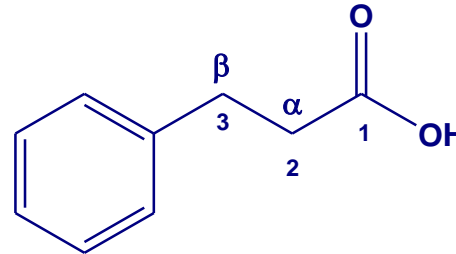
kwasy pentanowy
kwasy walerianowy



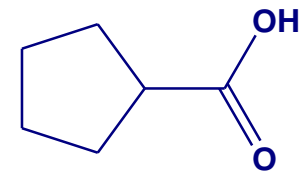
kwasy propenowy
kwasy akrylowy



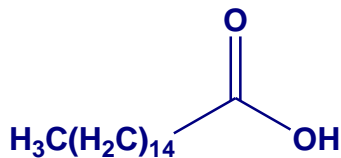
kwasy *trans*-but-2-enowy
kwasy krotonowy



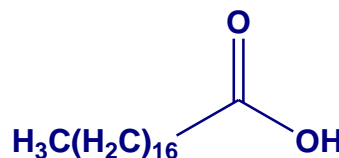
kwasy 3-fenylpropionowy
kwasy β -fenylpropionowy



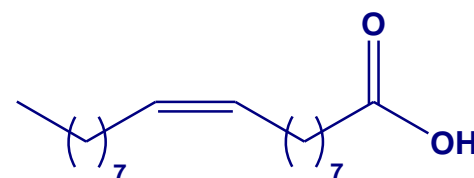
kwasy cyklopentanokarboksylowy
karboksycyklopentan



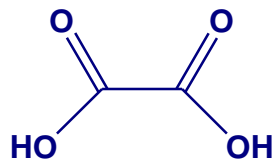
kwasy palmitynowy



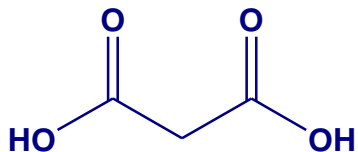
kwasy stearynowy



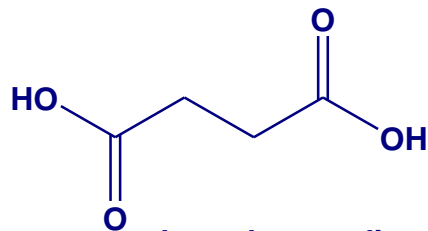
kwasy oleinowy



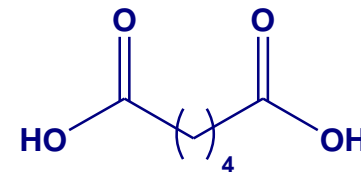
kwasi etanodiowy
kwasi szczawiowy



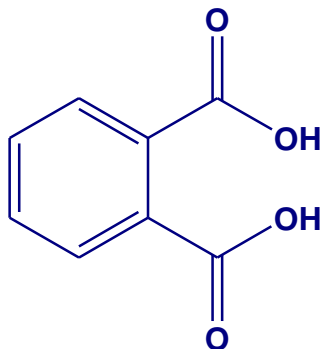
kwasi propanodiowy
kwasi malonowy



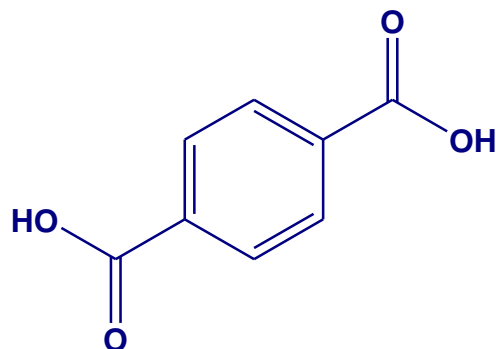
kwasi butanodiowy
kwasi etanodikarboksylowy
kwasi bursztynowy



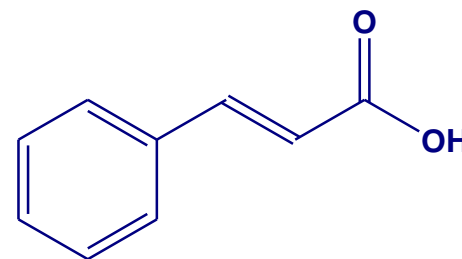
kwasi heksanodiowy
kwasi adypinowy



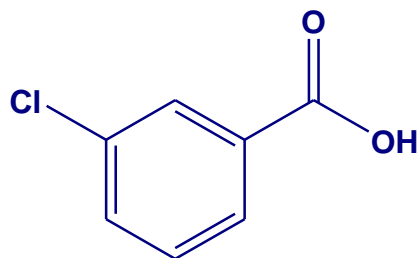
kwasi ftalowy
kwasi 1,2-benzenodikarboksylowy



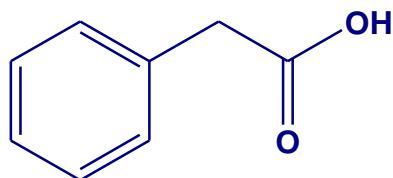
kwasi tereftalowy
kwasi 1,4-benzenodikarboksylowy



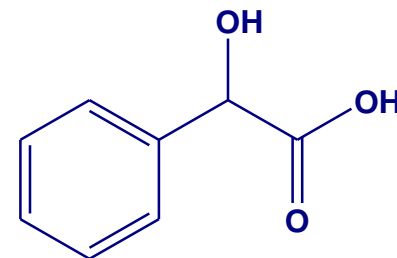
kwasi (E)-3-fenylprop-2-enowy
kwasi cynamonowy



kwasi m-chlorobenzoesowy



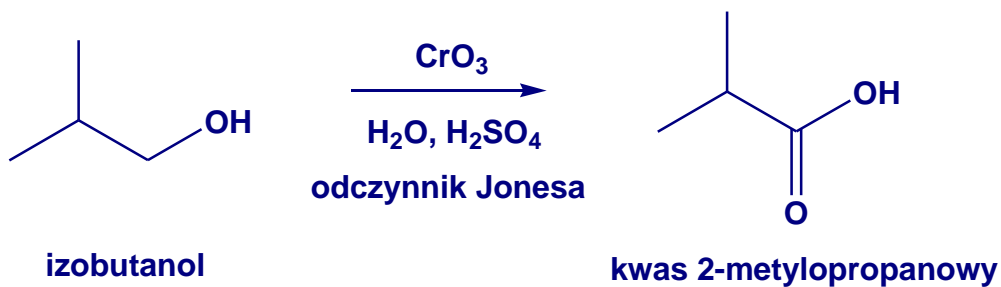
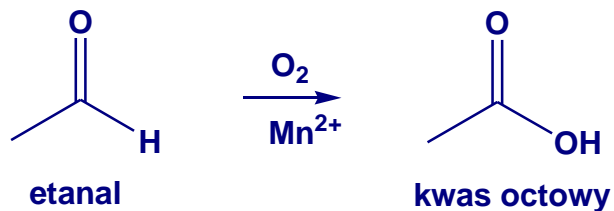
kwasi fenylaoctowy



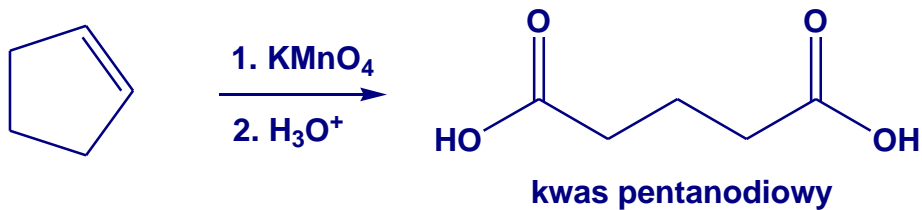
kwasi 2-fenyl-2-hydroksyoctowy
kwasi migdałowy

Otrzymywanie kwasów karboksylowych

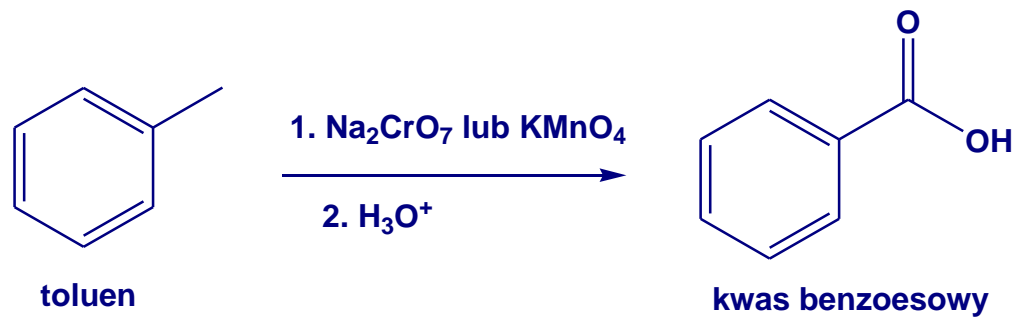
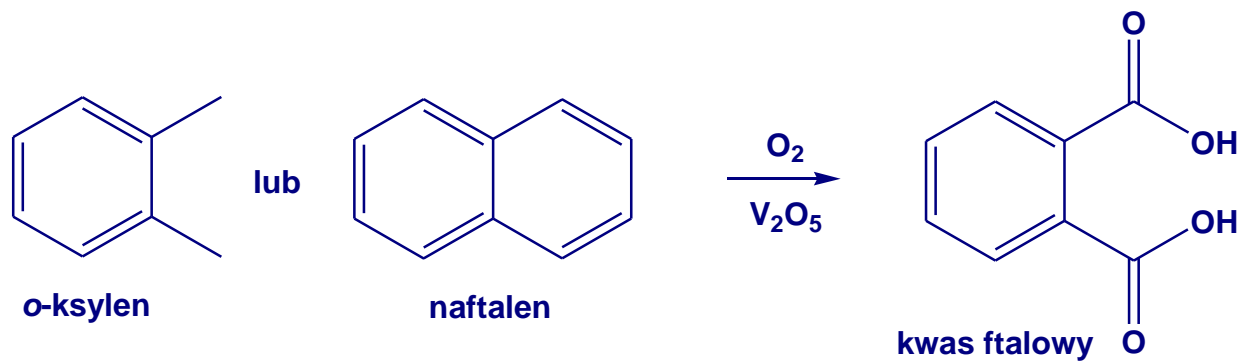
Utlenianie alkoholi i aldehydów



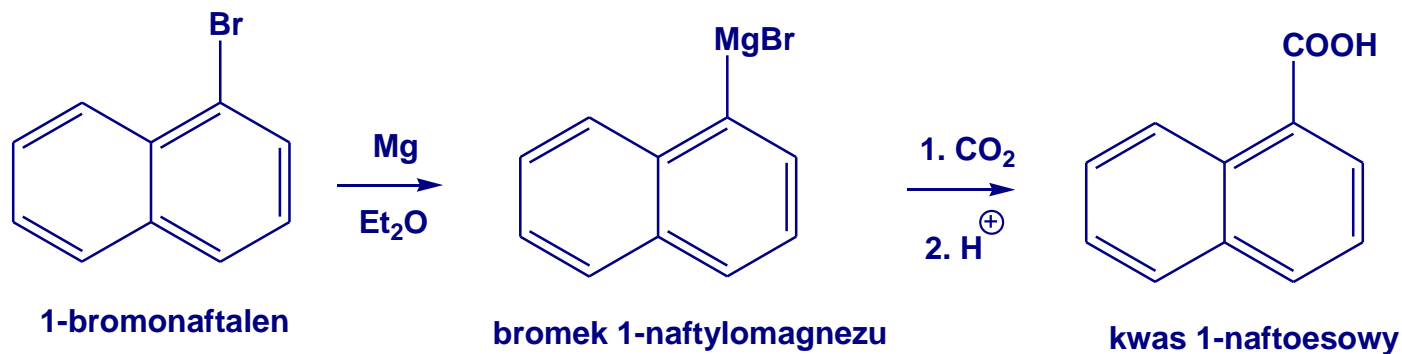
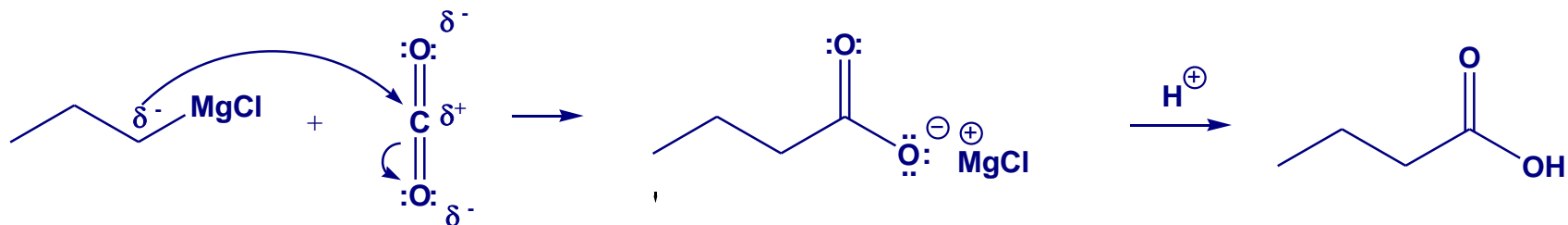
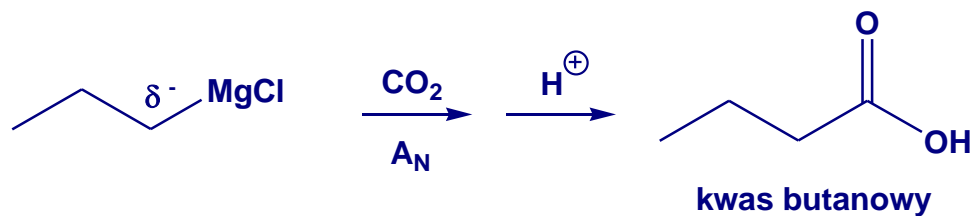
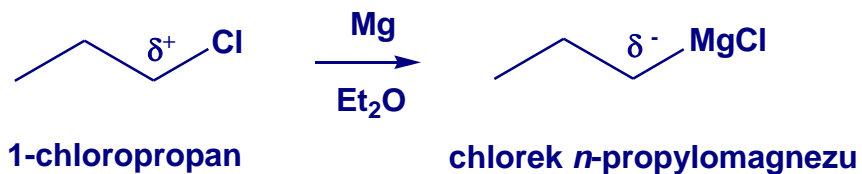
Utlenianie alkenów



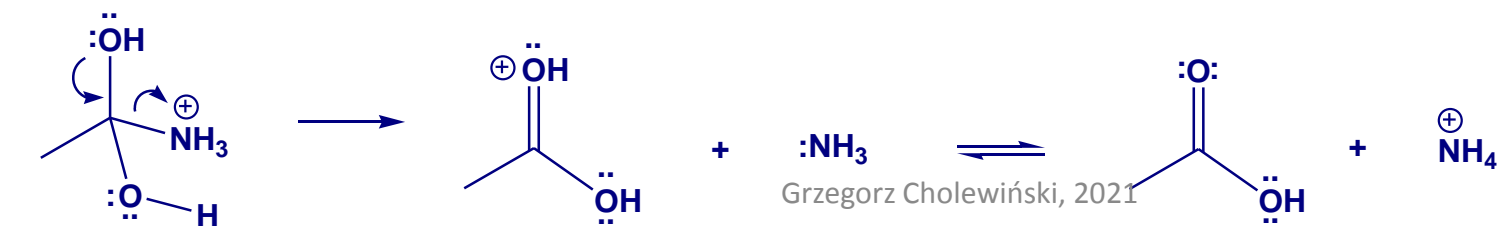
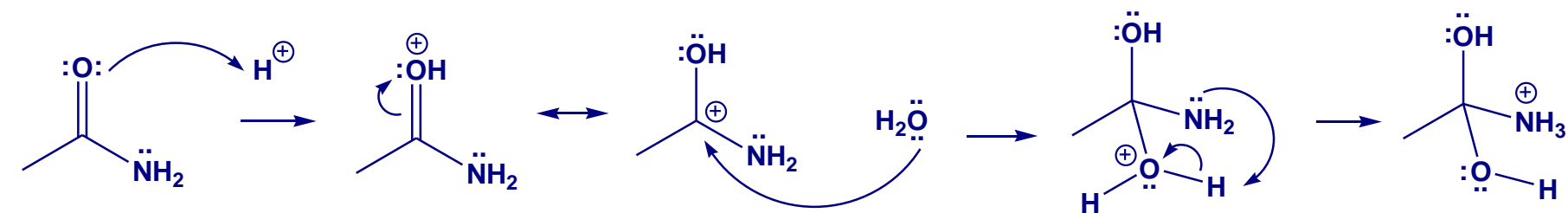
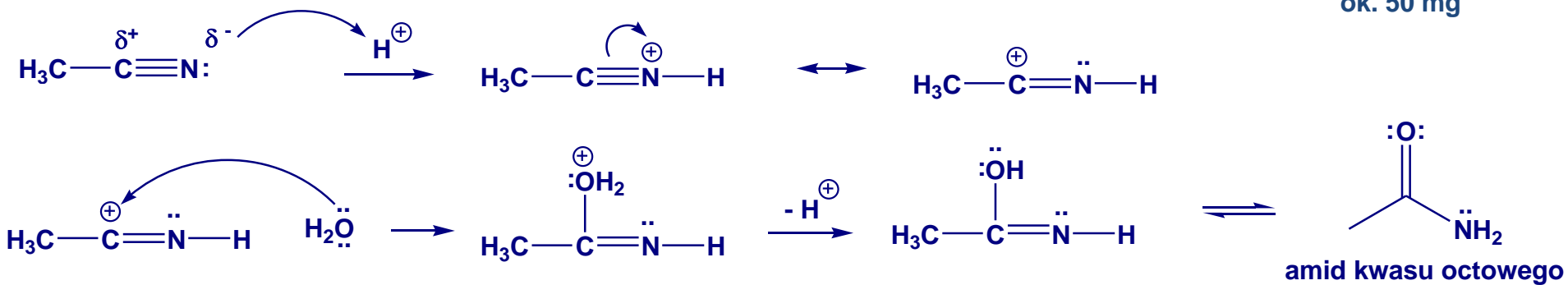
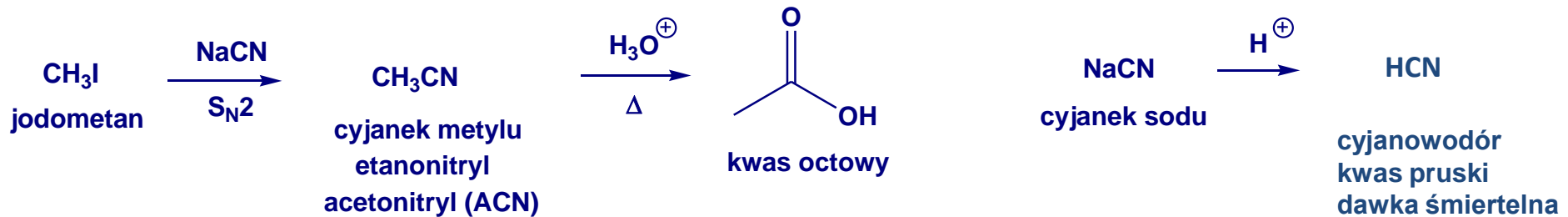
Utlenianie pochodnych aromatycznych



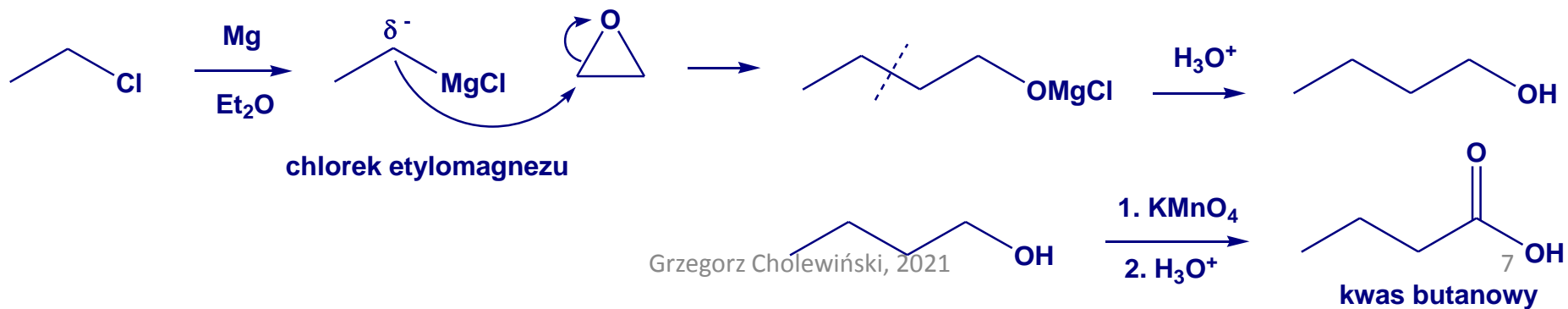
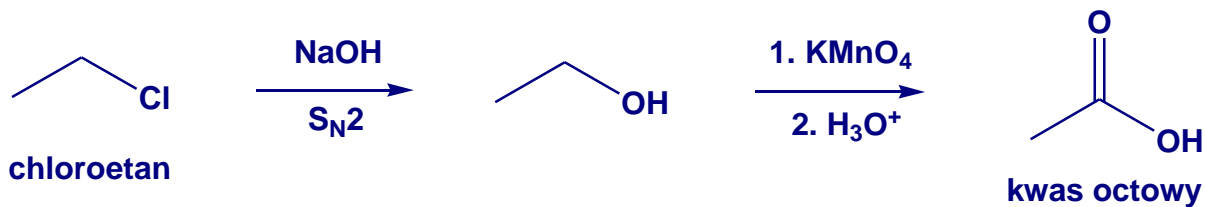
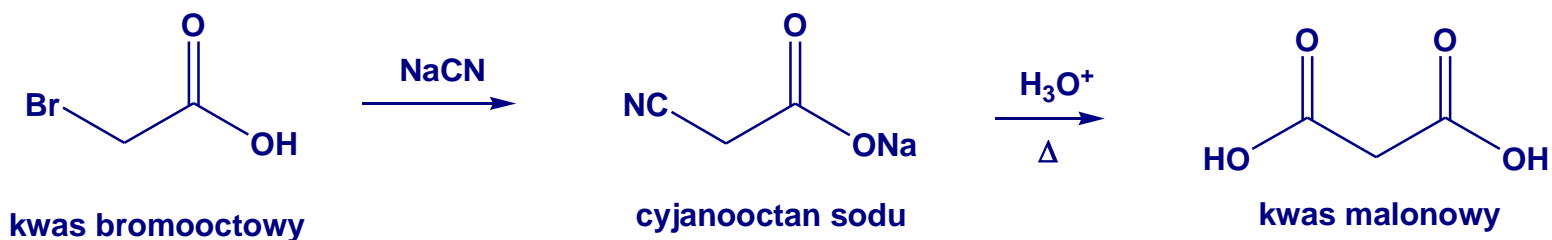
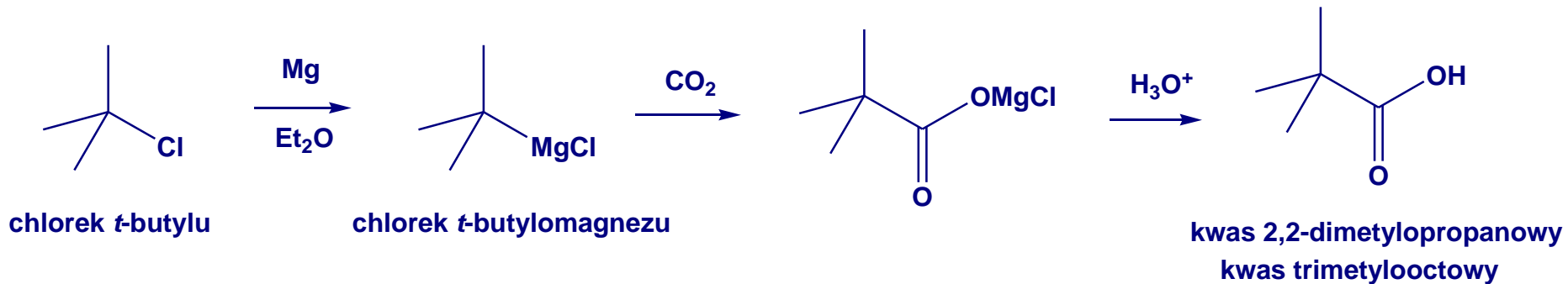
Addycja odczynników Grignarda (związków magnezoorganicznych) do CO₂



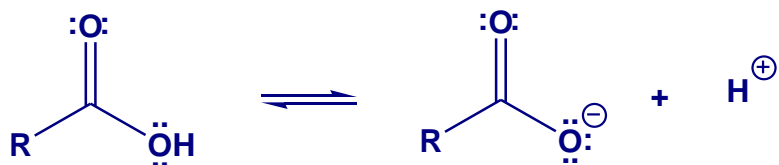
Hydroliza cyanków organicznych (nitryli)



Przykłady otrzymywania kwasów karboksylowych

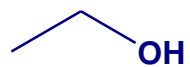


Kwasowość kwasów karboksylowych



$$K_a = \frac{[\text{A}^-][\text{H}_3\text{O}^+]}{[\text{AH}]} \quad \text{p}K_a = -\log K_a$$

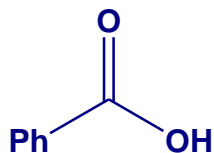
Im $\text{p}K_a$ niższe tym mocniejszy kwas



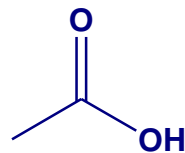
$\text{p}K_a$ 15,9

PhOH

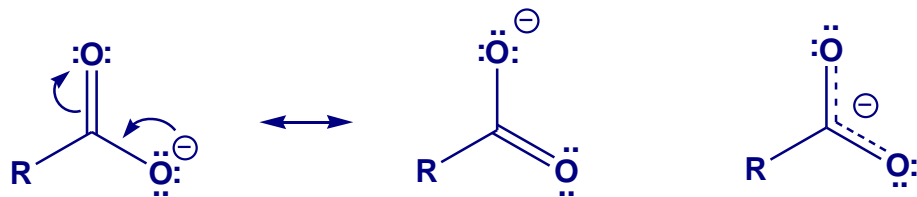
$\text{p}K_a$ 9,9



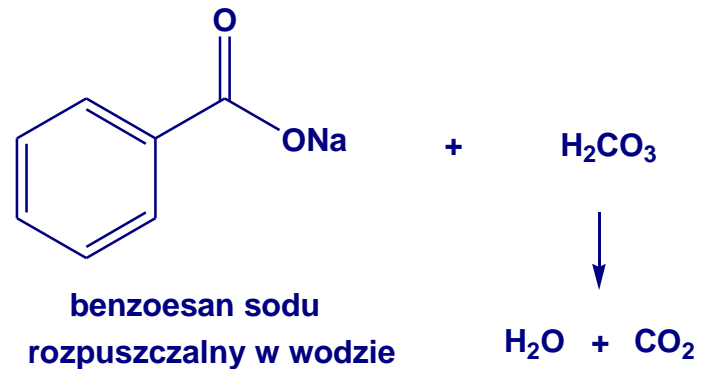
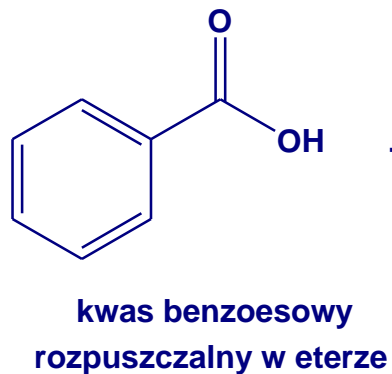
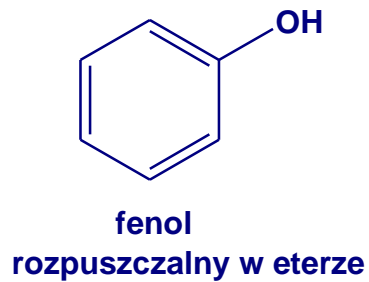
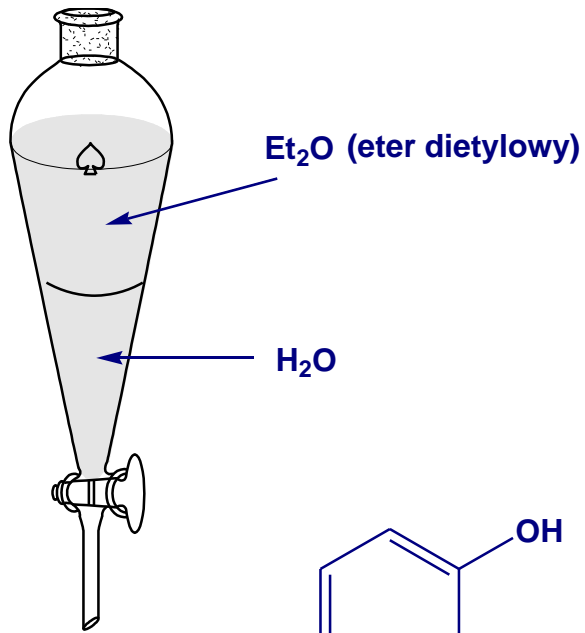
$\text{p}K_a$ 4,2



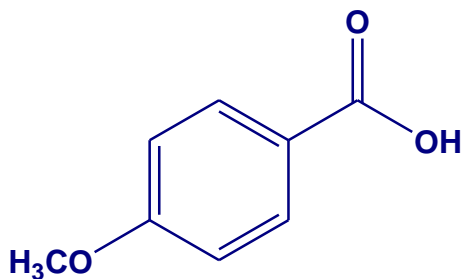
$\text{p}K_a$ 4,7



Wykorzystanie różnic w kwasowości w rozdzielaniu fenolu i kwasu benzoesowego za pomocą ekstrakcji

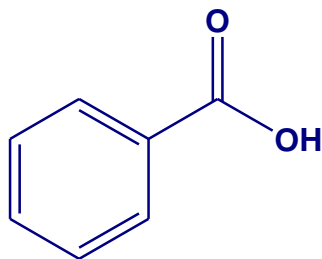


Wpływ podstawników na kwasowość kwasów karboksylowych



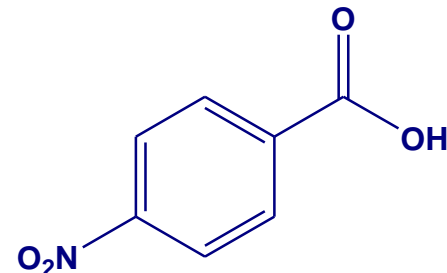
kwas *p*-metoksybenzoesowy

pKa 4,5



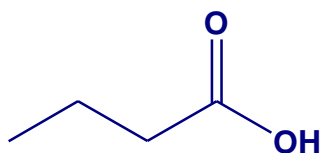
kwas benzoesowy

pKa 4,2



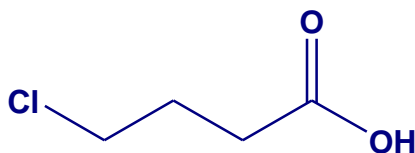
kwas *p*-nitrobenzoesowy

pKa 3,4



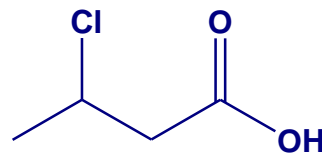
kwas butanowy

pKa 4,8



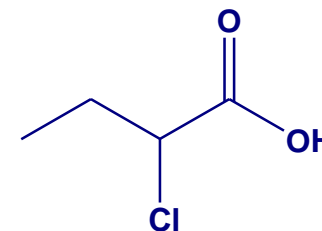
kwas 4-chlorobutanowy
kwas γ -chlorobutanowy

pKa 4,5



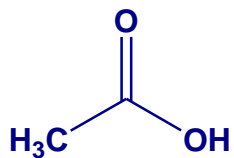
kwas 3-chlorobutanowy
kwas β -chlorobutanowy

pKa 4,1



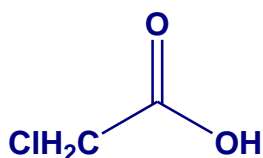
kwas 2-chlorobutanowy
kwas α -chlorobutanowy

pKa 2,9



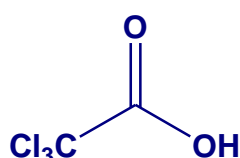
kwas octowy

pKa 4,8



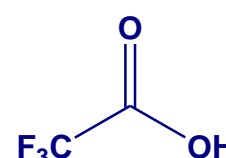
kwas chlorooctowy

pKa 2,9



kwas trichlorooctowy

pKa 0,6



kwas trifluorooctowy

pKa 0,2

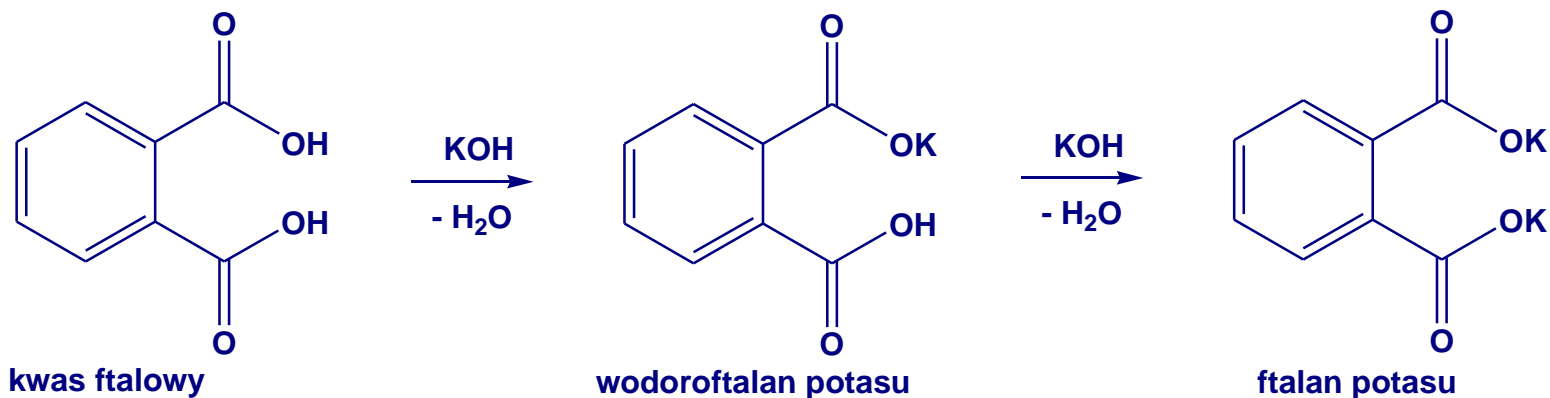
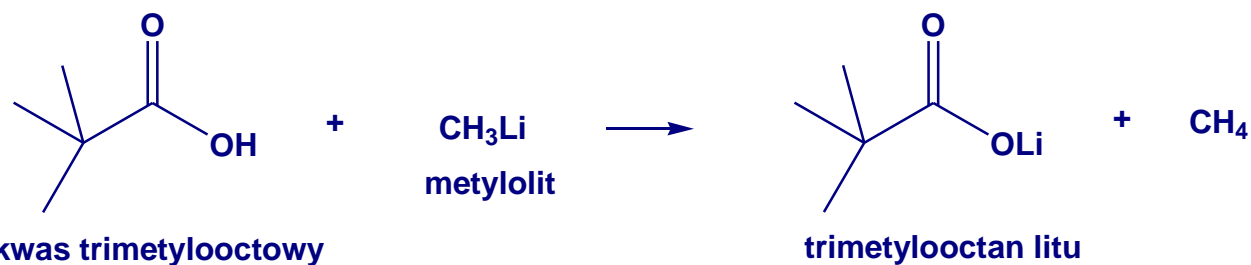
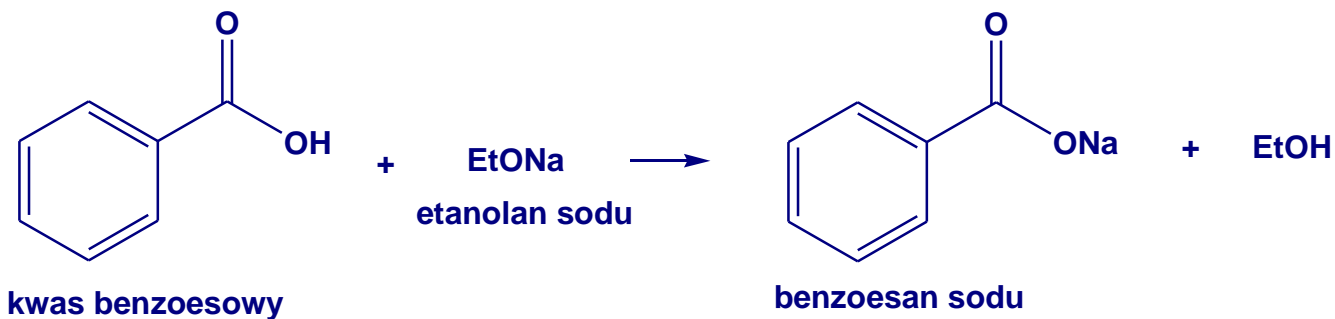
HCl

kwas chlorowodorowy

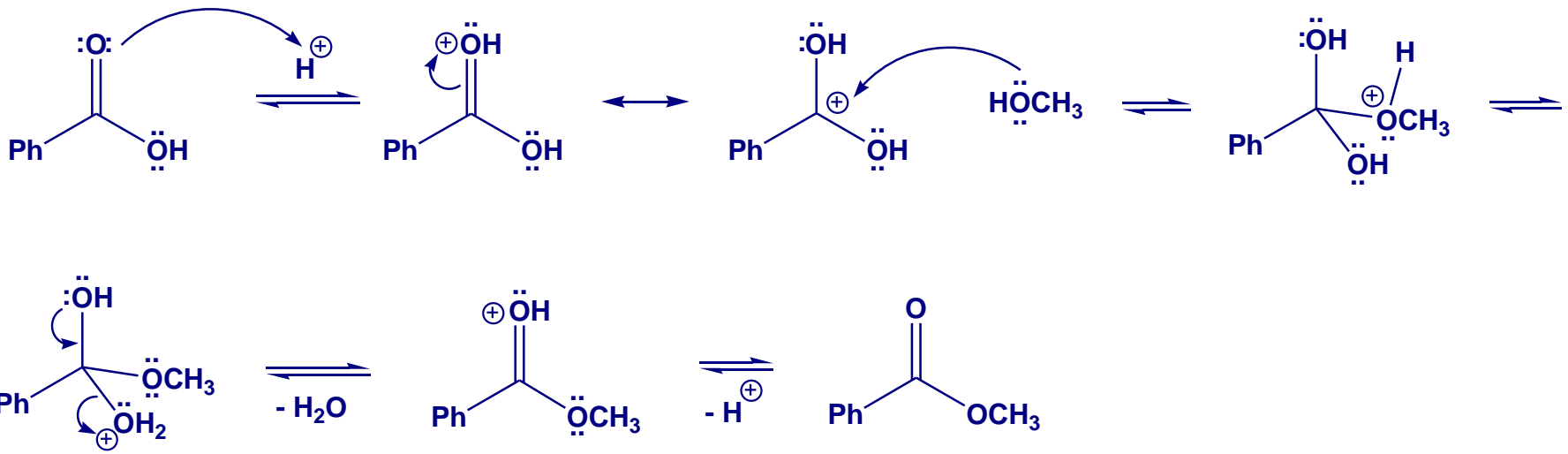
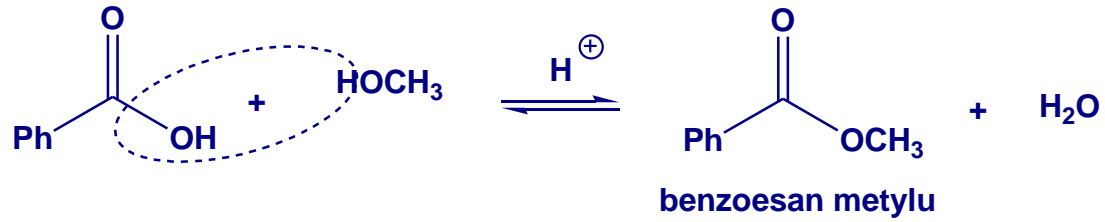
pKa - 7 10

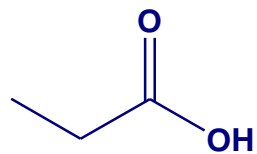
Reaktywność kwasów karboksylowych

Tworzenie soli

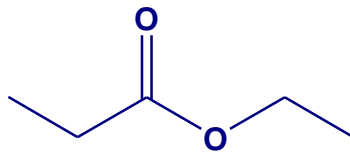
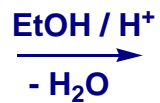


Estryfikacja Fishera

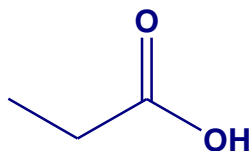
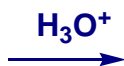
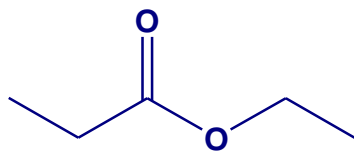




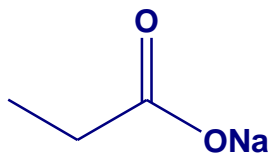
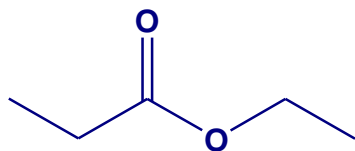
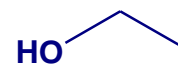
kwas propionowy



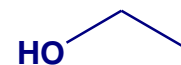
propionian etylu



+

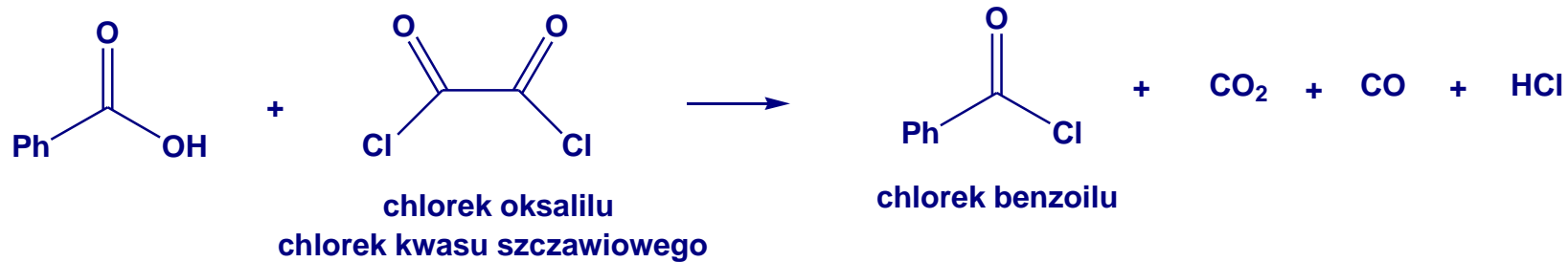
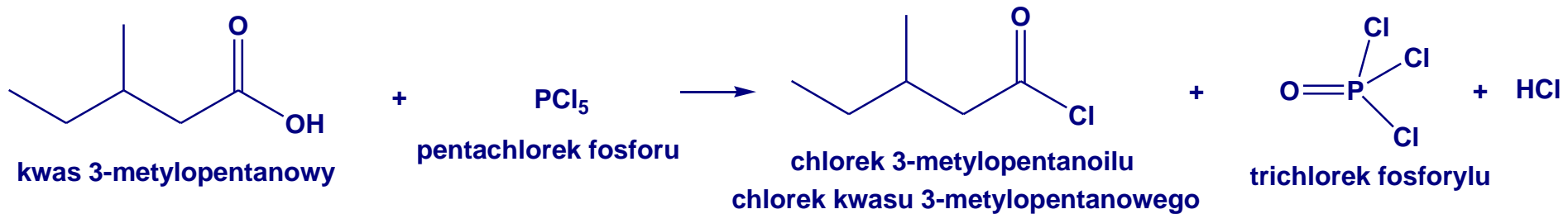
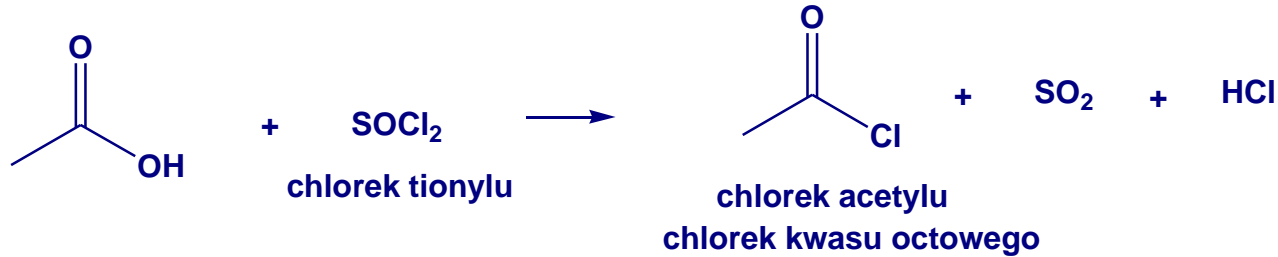


+



propionian sodu

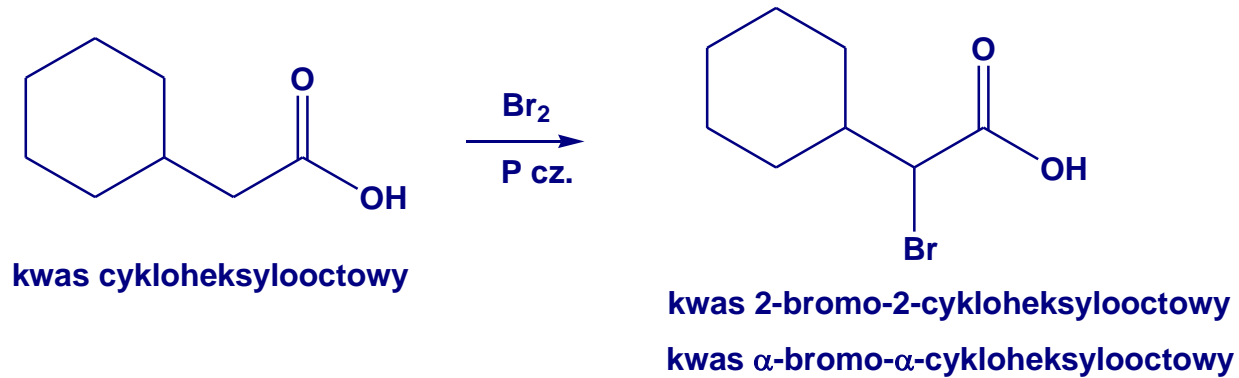
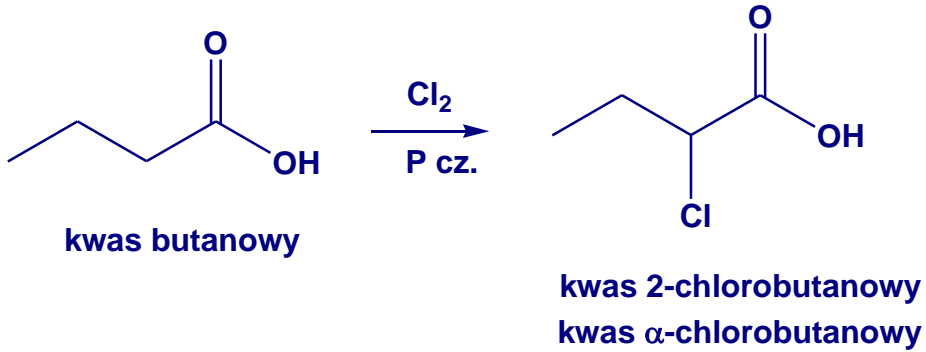
Powstawanie halogenków acylowych (kwasowych)



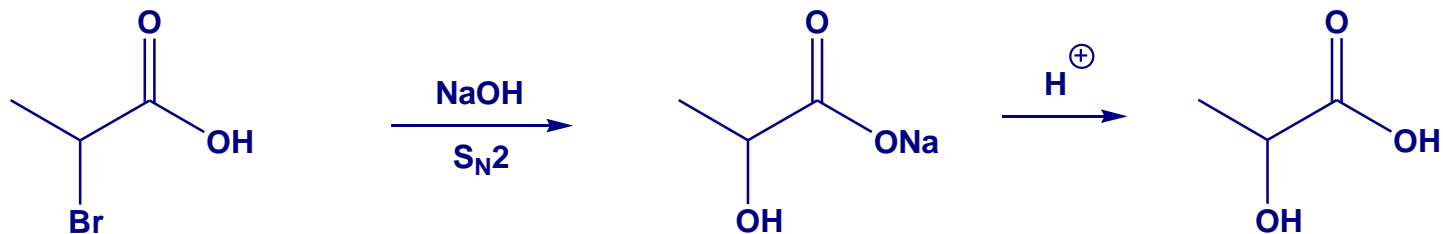
Inne odczynniki przekształcające kwasy karboksylowe w halogenki acylu to m.in.: trichlorek fosforu PCl_3 , trichlorek fosforylu $\text{O}=\text{PCl}_3$, a także bromek tionylu SOBr_2 , pentabromek fosforu PBr_5 , tribromek fosforu PBr_3 , tribromek fosforylu $\text{O}=\text{PBr}_3$ (powstają odpowiednio bromki acylu).

α -halogenokwasy

Reakcja Hella – Volharda - Zielińskiego

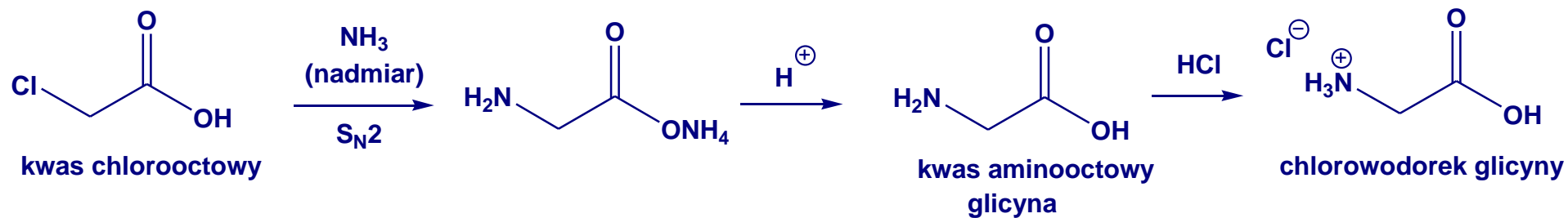


Wykorzystanie α -halogenokwasów w syntezie



kwas 2-bromopropionowy
kwas α -bromopropionowy

kwas 2-hydroksypropionowy
kwas α -hydroksypropionowy

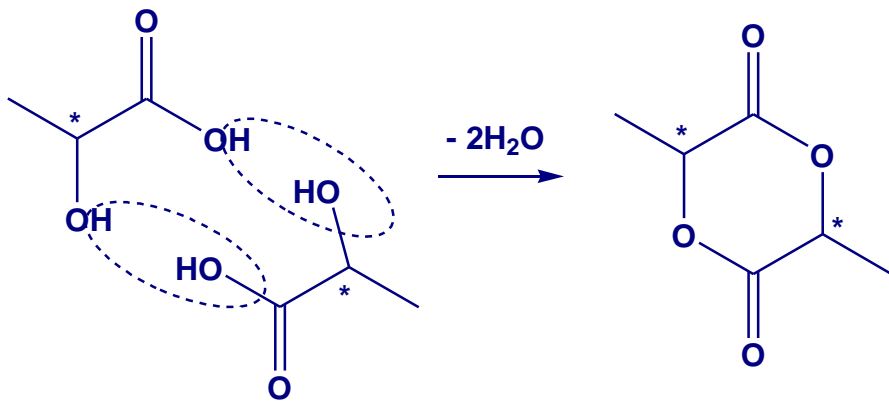


kwas chlorooctowy

kwas aminooctowy
glicyna

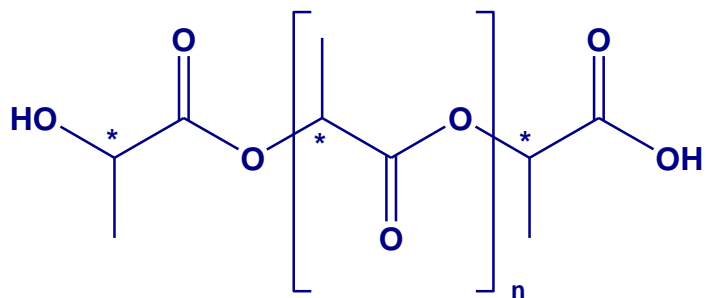
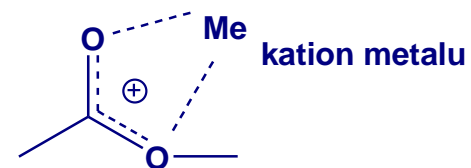
chlorowoderek glicyny

Przykład syntezy polimeru biodegradowalnego

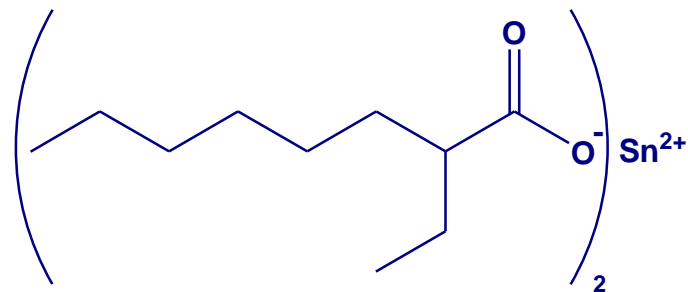


kwask mlekowy

laktyd kwasu mlekowego



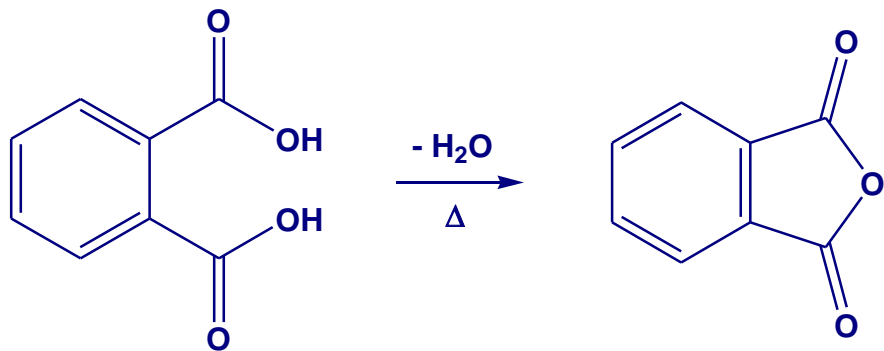
polilaktyd (poliester kwasu mlekowego)



2-etyloheksanian cyny(II)

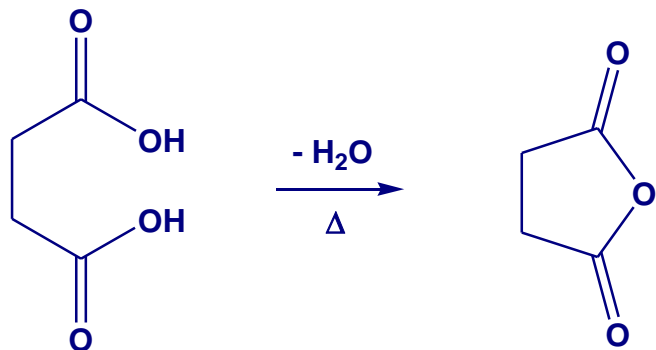
Powstawanie bezwodników kwasów karboksylowych

Cyklizacja do trwałego pierścienia



kwas ftalowy

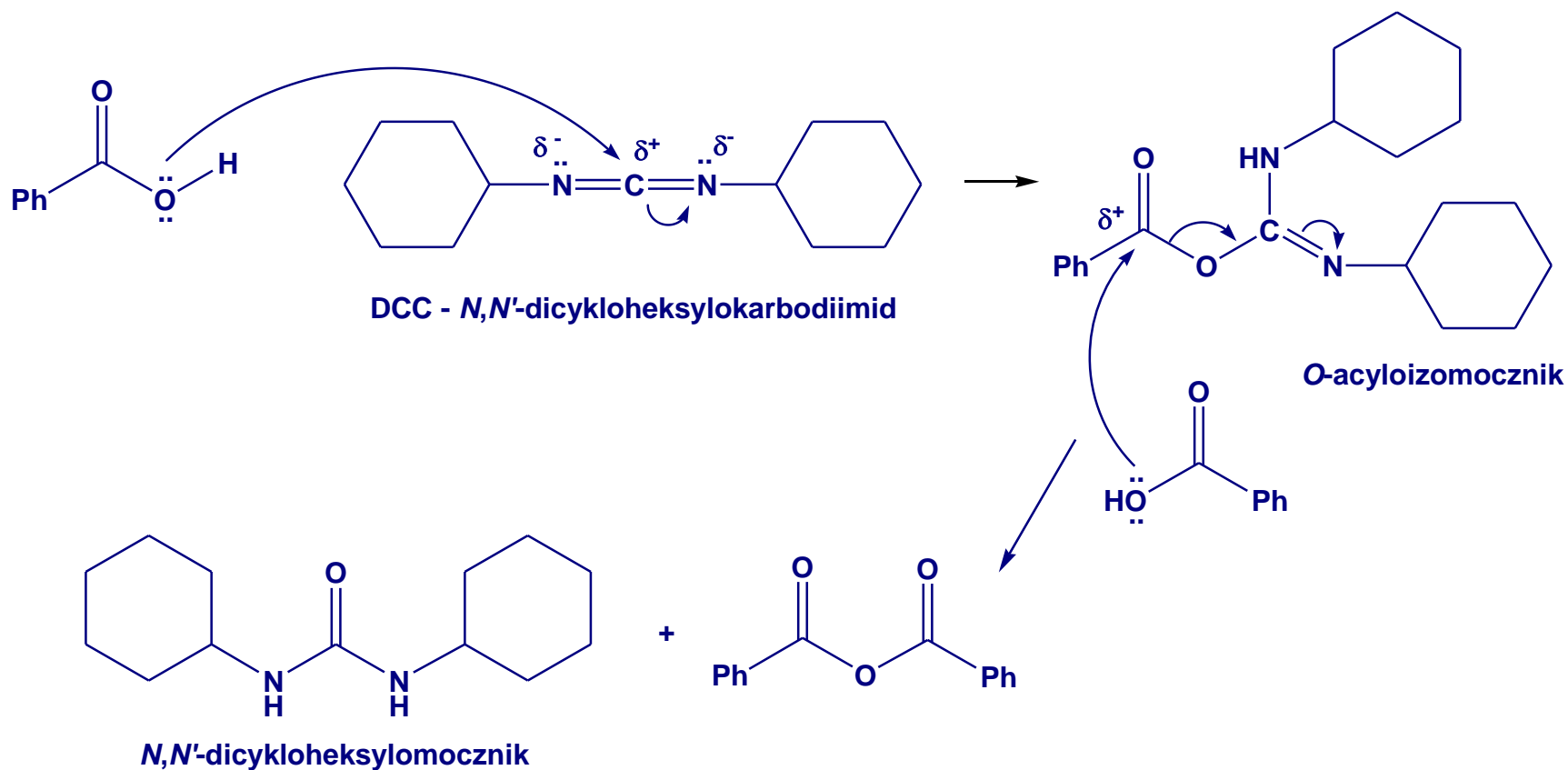
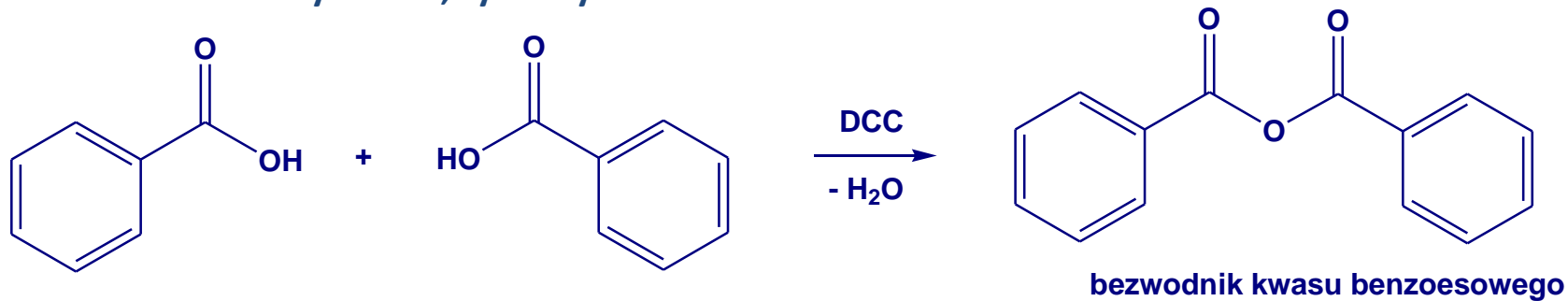
bezwodnik kwasu ftalowego



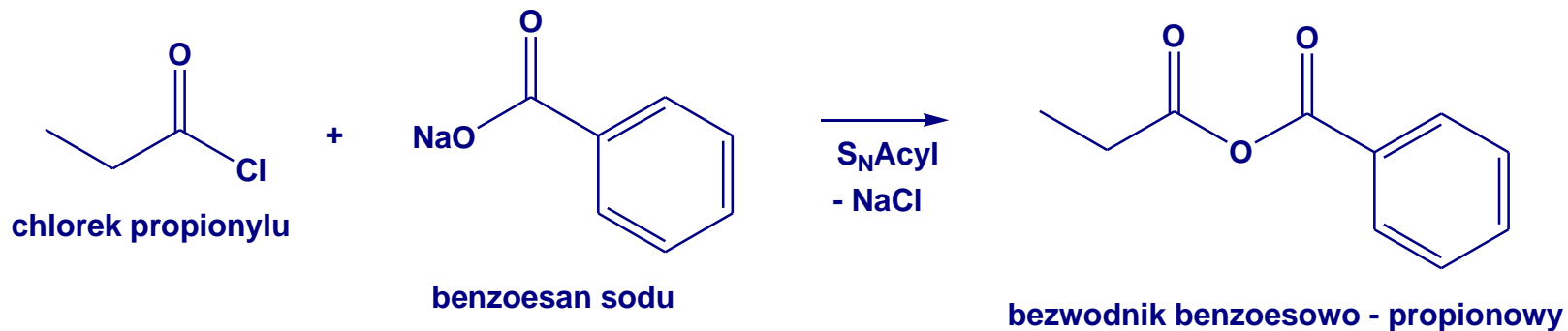
kwas butanodiowy
kwas bursztynowy

bezwodnik kwasu bursztynowego

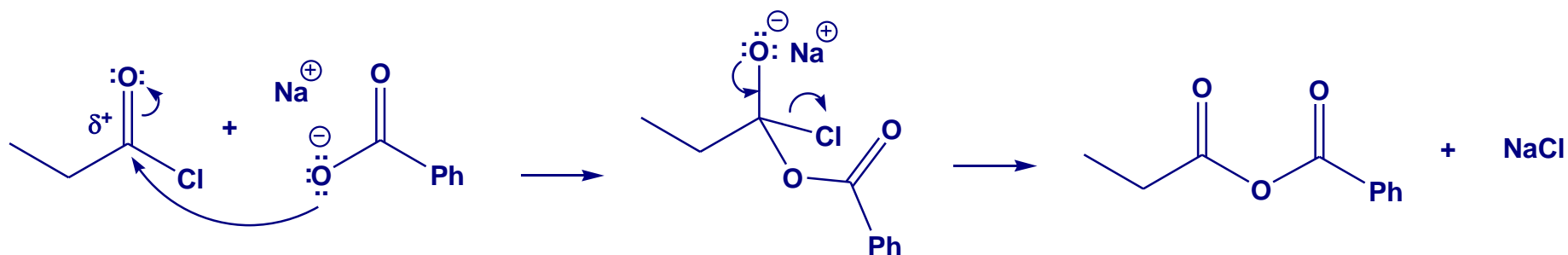
Bezwodniki niecykliczne, symetryczne



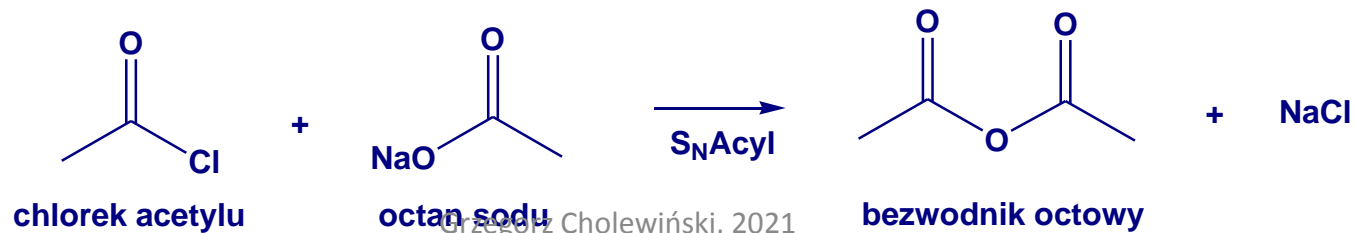
Bezwodniki niesymetryczne



Podstawienie nukleofilowe na acylowym atomie węgla S_NAcyl



Zastosowanie tej metody dla bezwodnika symetrycznego:



Otrzymywanie amidów kwasów karboksylowych

