Universitas Esa Unggul
Smart, Creative and Entrepreneurial

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Senyawa-senyawa Turunan Asam Karboksilat

PERTEMUAN 13

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Program Studi Gizi
Universitas Esa Unggul

KEMAMPUAN AKHIR YANG DIHARAPKAN

- Mahasiswa mampu menjelaskan tatanama, sifat fisik, sifat kimia, sintesis, dan reaksi senyawa-senyawa asam karboksilat dan turunannya

Turunan Asam Karboksilat

Klorida asam

Asam anhidrida

Ester

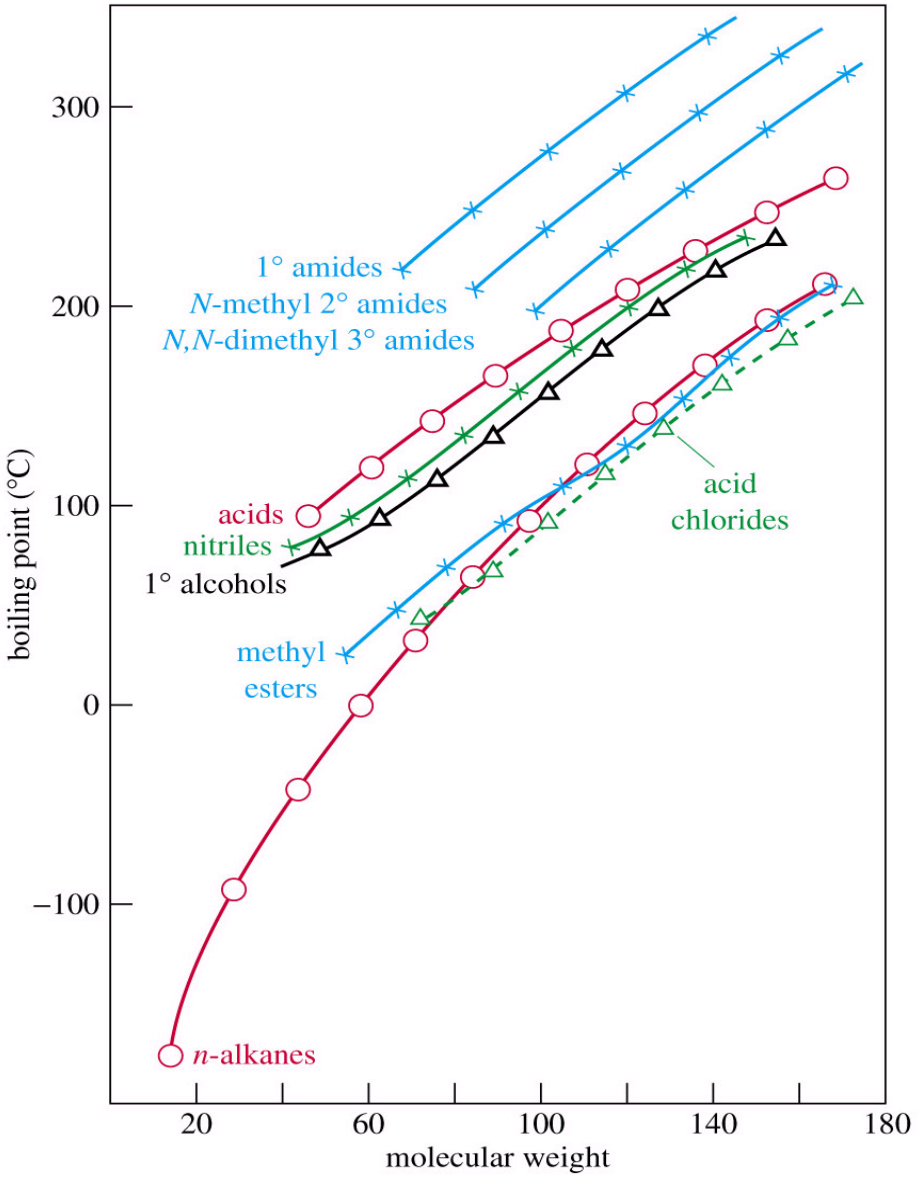
Amida

Nitril

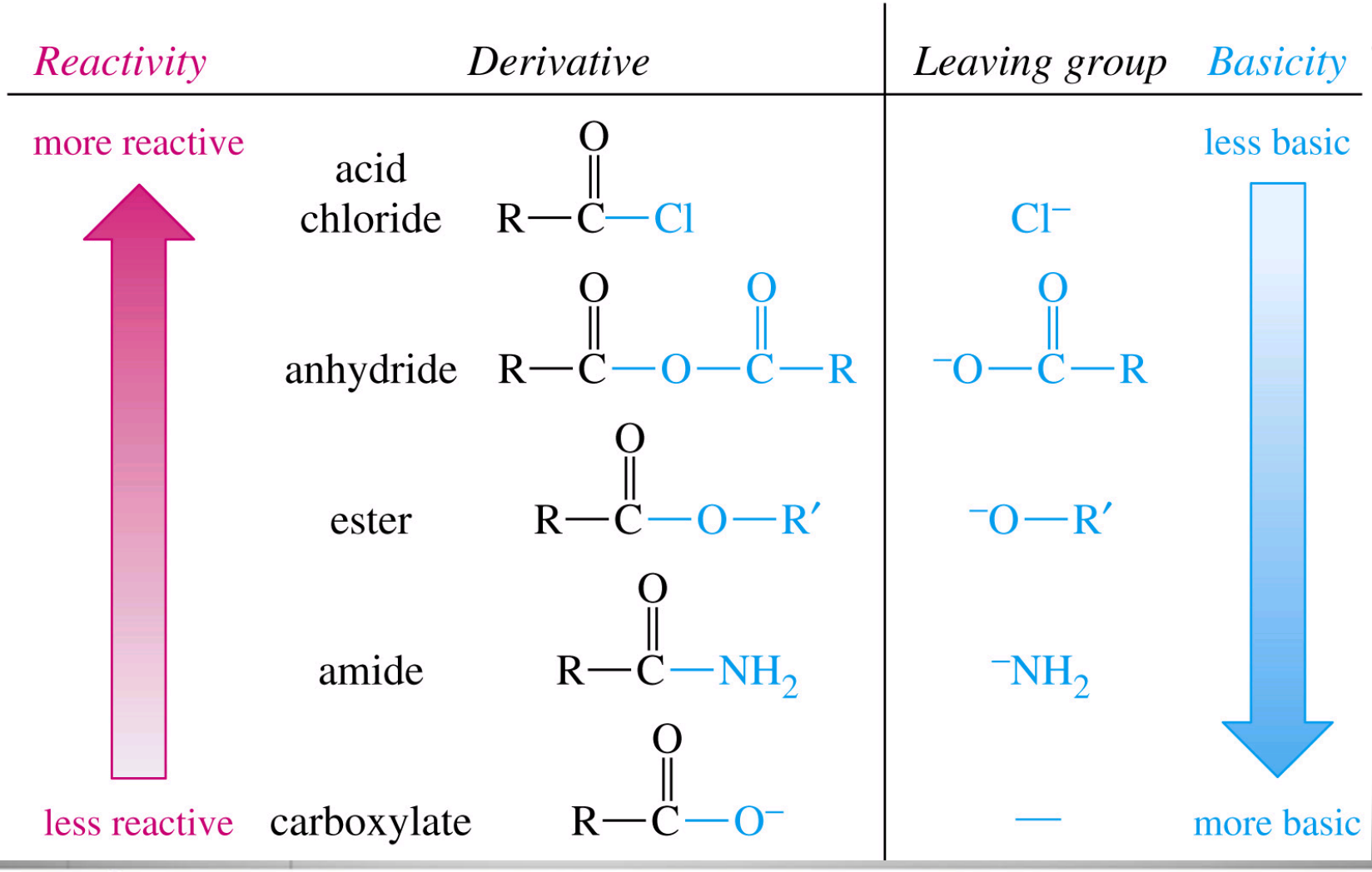
Substitusi Nukleofilik

Sifat Fisik Senyawa Turunan Asam Karboksilat

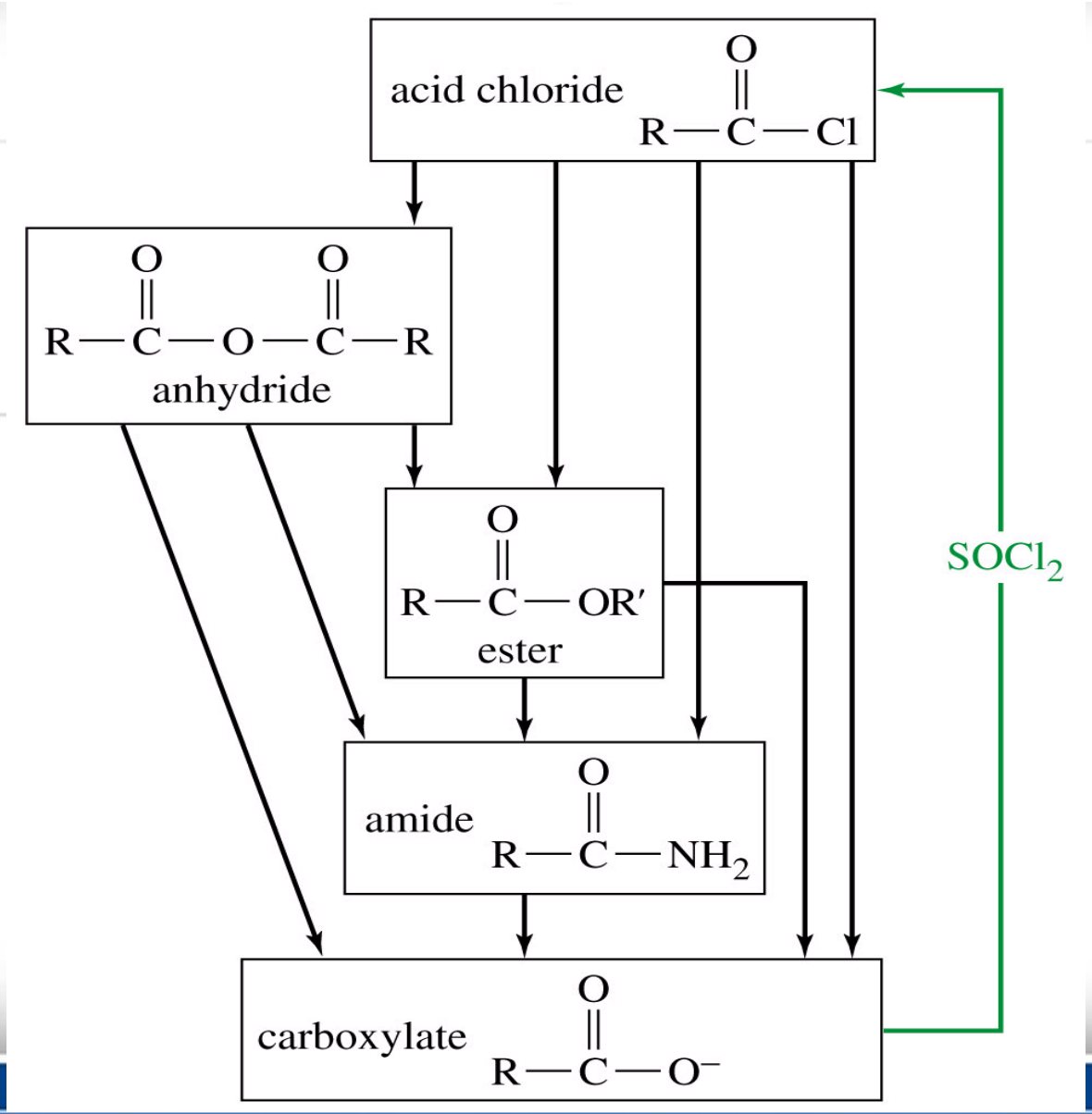
Examples (MW 55–60)	bp (°C)
$CH_3-\overset{\overset{O}{\|}}{C}-NH_2$	222
$CH_3-\overset{\overset{O}{\|}}{C}-OH$	118
$CH_3CH_2CH_2OH$	97
$CH_3CH_2-C\equiv N$	97
$H-\overset{\overset{O}{\|}}{C}-OCH_3$	32
$CH_3CH_2CH_2CH_3$	0



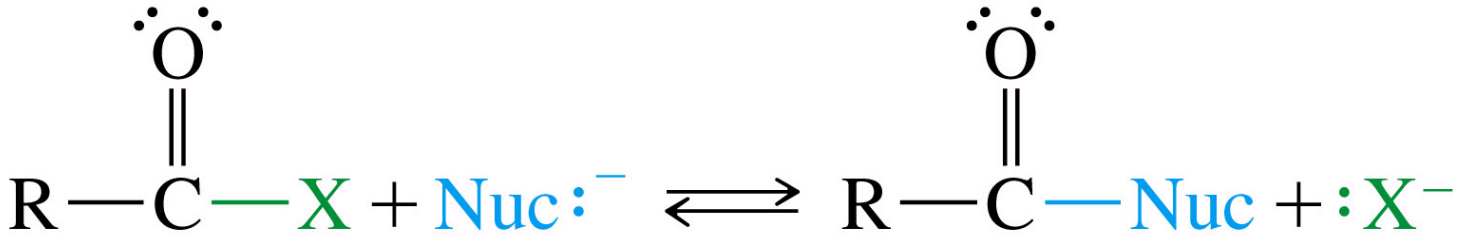
Reaktivitas Turunan Asam Karboksilat

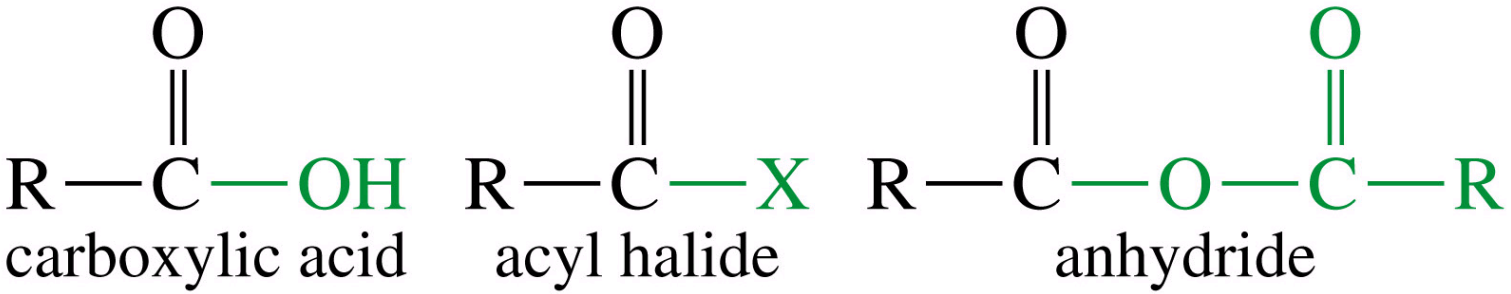


Reaksi Konversi Gugus Fungsu Turunan Asam Karboksilat



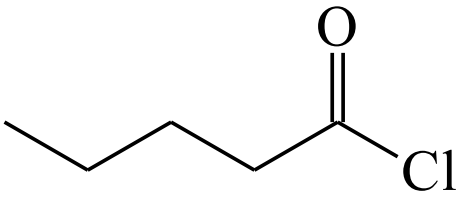
Substitusi Nukleofilik





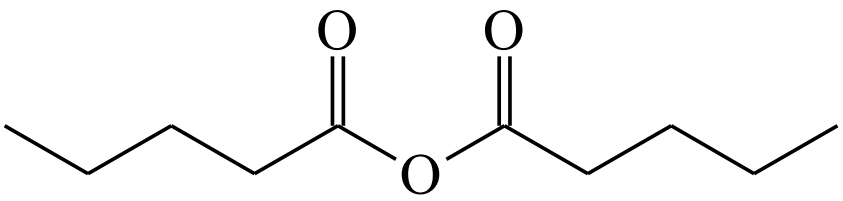
Tatanama IUPAC

(menggunakan template asam karboksilat)



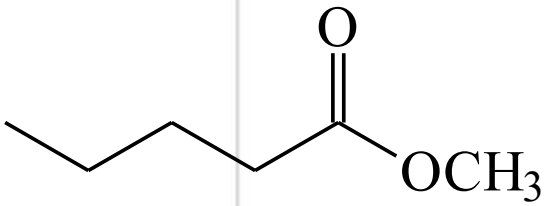
drop "ic acid" add "yl chloride"

pentanoyl chloride



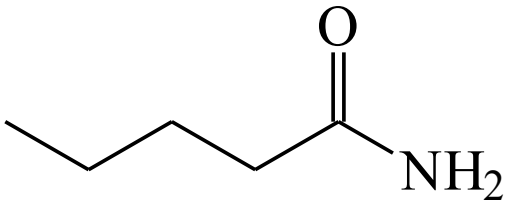
drop "acid" add "anhydride"

pentanoic anhydride



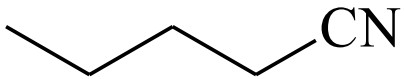
"alkyl" _ drop "ic acid" add "ate"

methyl pentanoate



drop "oic acid" add "amide"

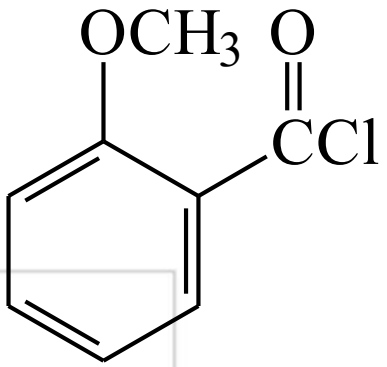
pentanamide



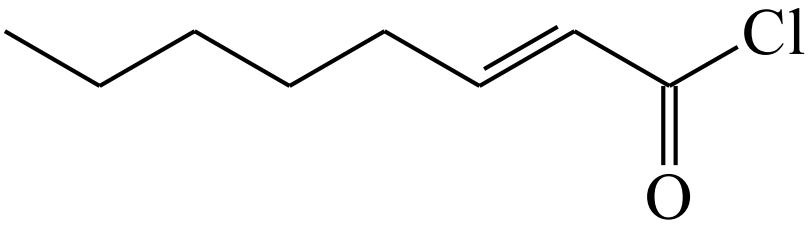
drop "ic acid" add "e_nitrile"

pentanenitrile

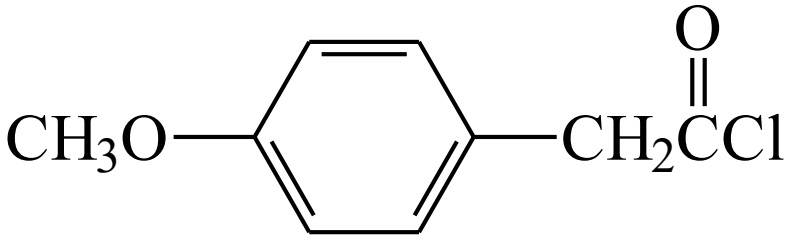
Klorida Asam



o-methoxybenzoyl chloride

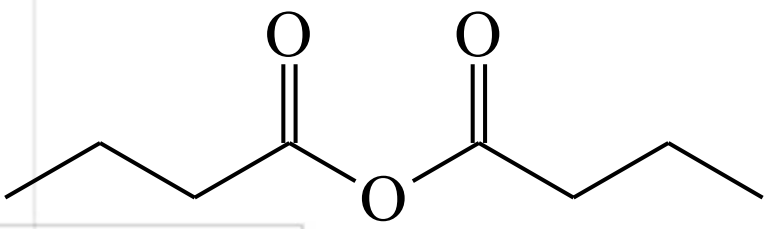


(E) 2-octenoyl chloride

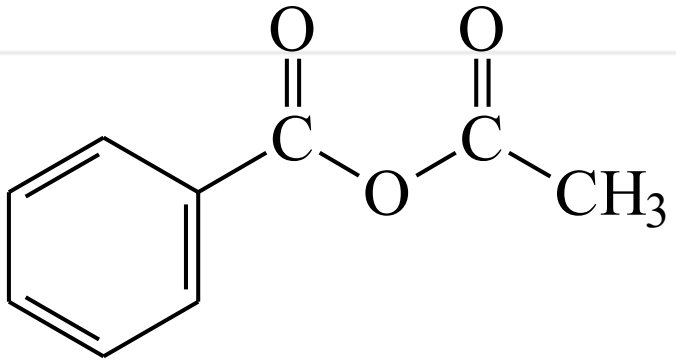


(p-methoxyphenyl)acetyl chloride

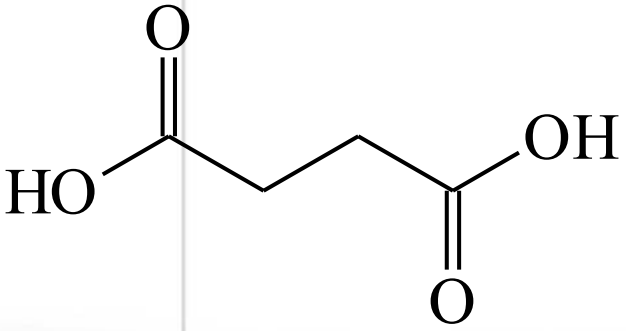
Asam Anhidrida



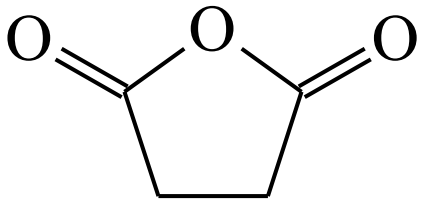
butanoic anhydride
butyric anhydride



acetic benzoic anhydride

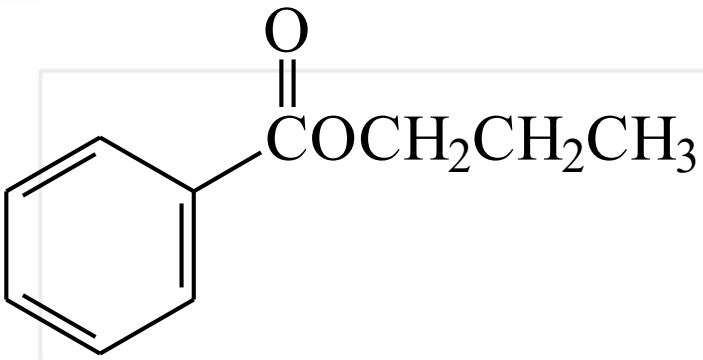


succinnic acid

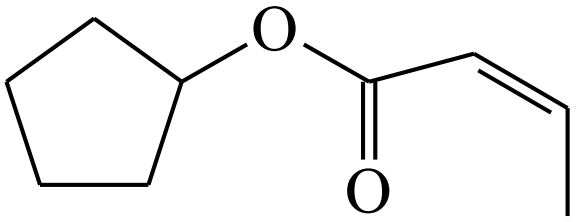


succinnic anhydride

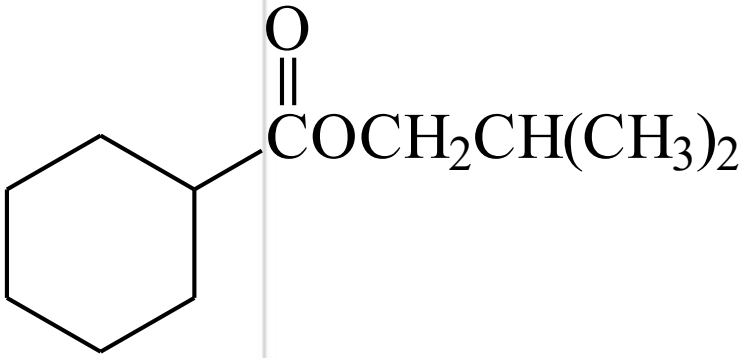
Ester



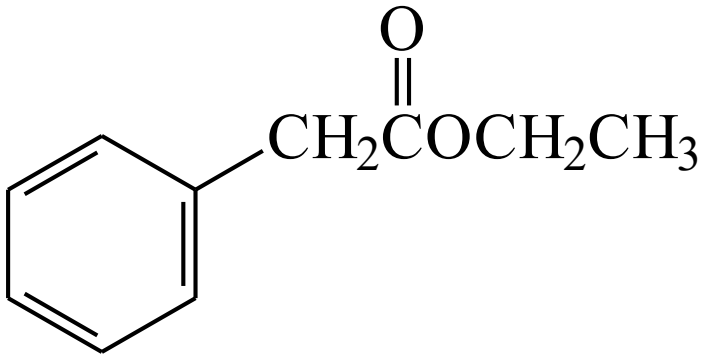
propyl benzoate



(Z) cyclopentyl 2-butenoate

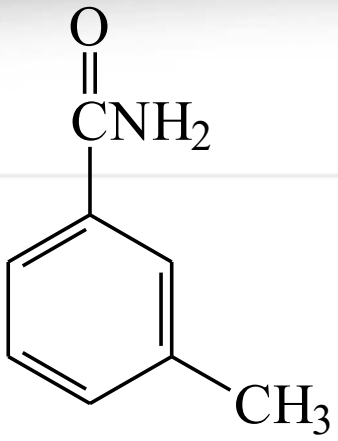


isobutyl cyclohexanecarboxylate

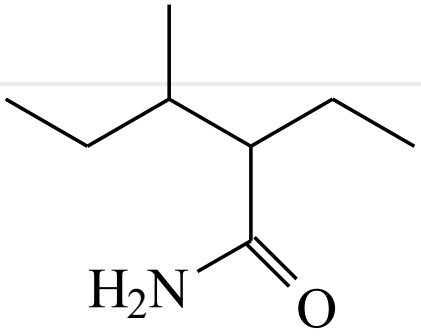


ethyl phenylacetate

Amida

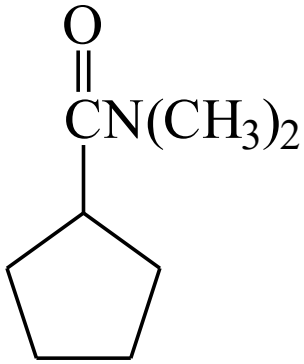


meta methylbenzamide

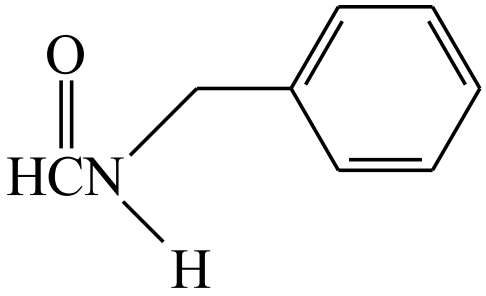


2-ethyl-3-methylpentanamid

α-ethyl-β-methylvaleramide

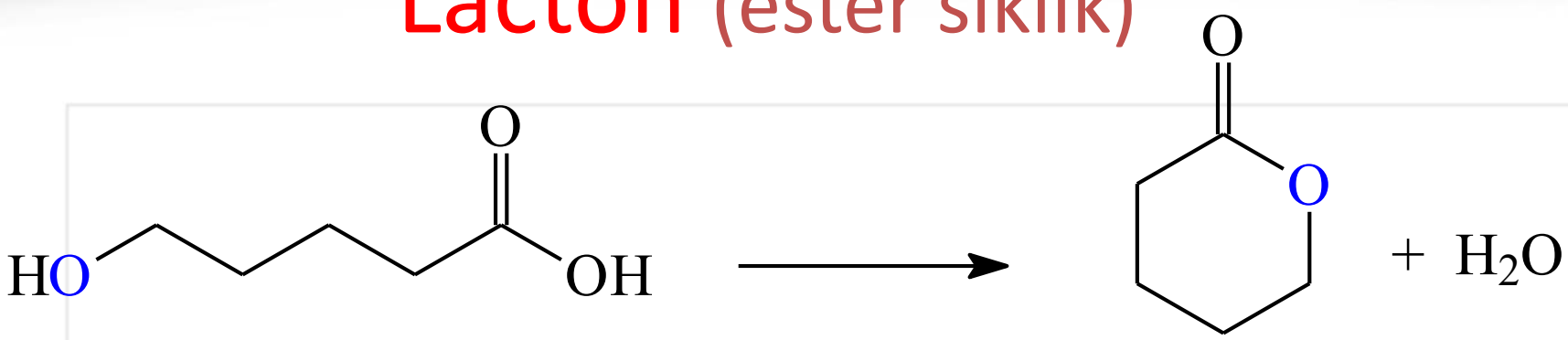


N,N-dimethylcyclopentanecarboxamide

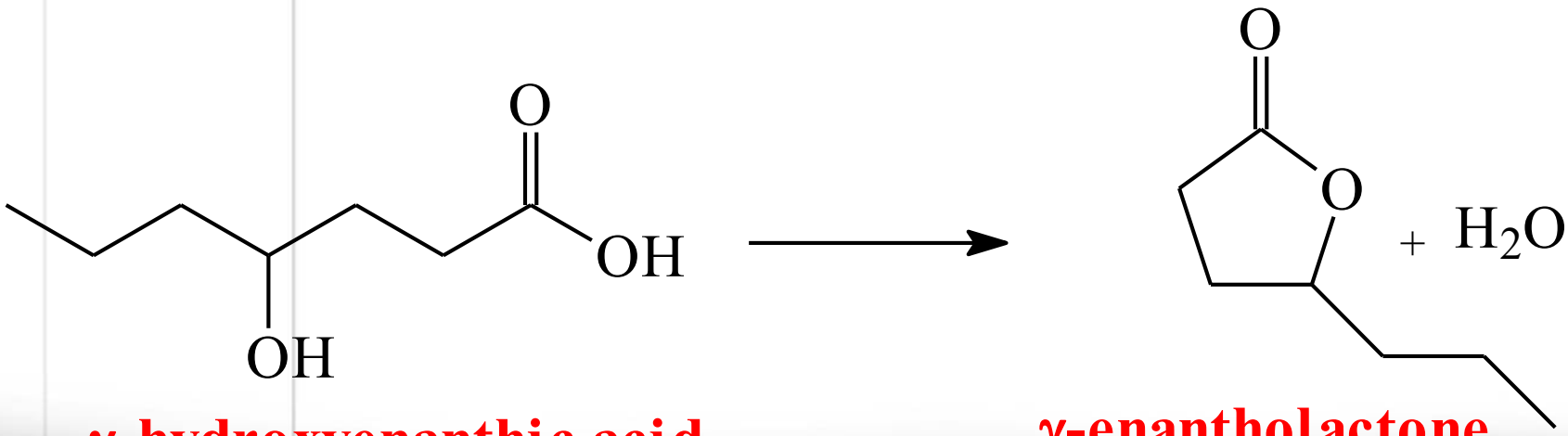


N-benzylformamide

Lacton (ester siklik)

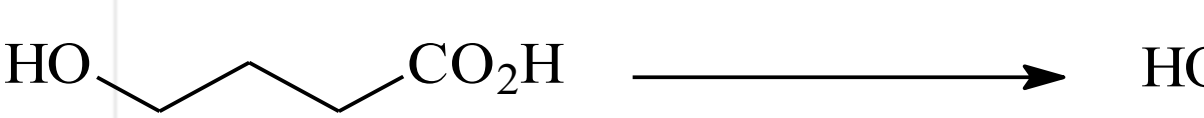


δ-hydroxyvaleric acid **δ-valerolactone**

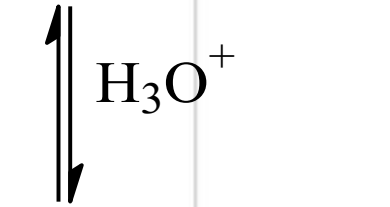


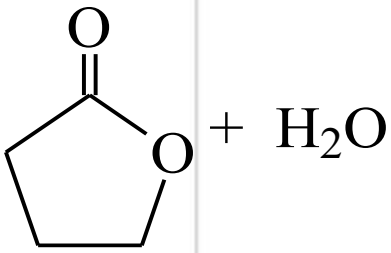
γ-hydroxyenanthic acid **γ-enantholactone**

Asam γ-Hidroksibutirat

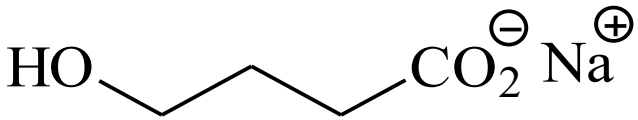


γ-hydroxybutyric acid





γ-butyrolactone



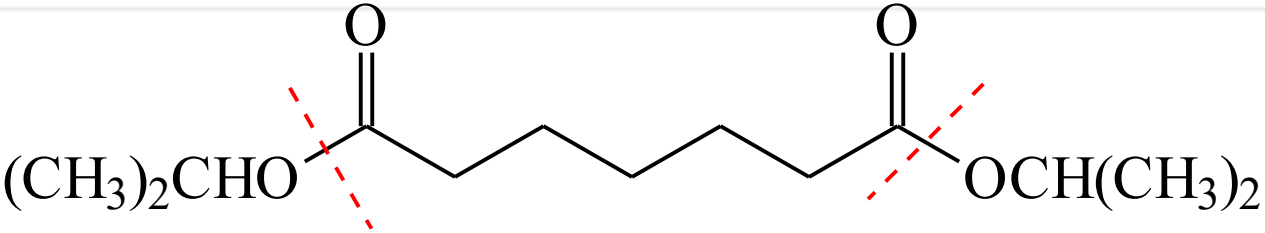
sodium 4-hydroxybutanoat
or sodium γ-hydroxybutyrat
(GHB)

CNS depressant

as of 2000, Schedule I
controlled substance

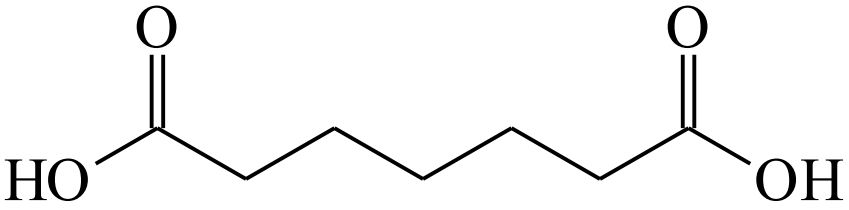
If mixed with ROH, the depressant
effects are enhanced

Semua turunan asam karboksilat dapat dihidrolisis menghasilkan asam karboksilat



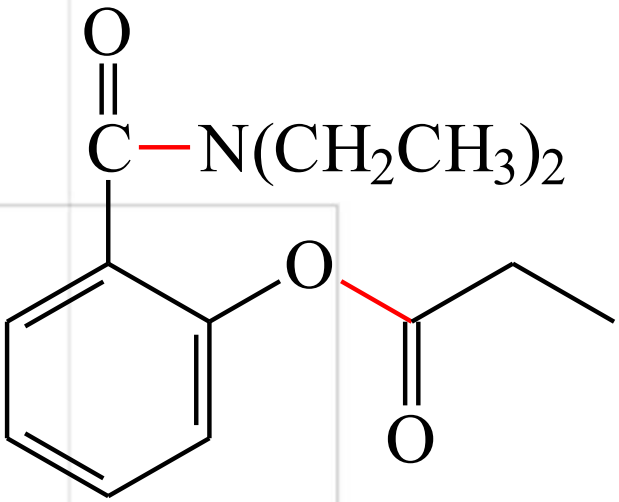
diisopropyl pimelate

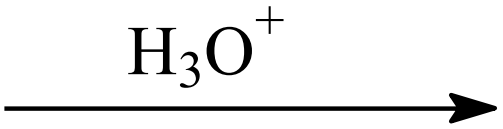
Hydrolysis
H_3O^+ or
in base



+ 2 $(CH_3)_2CHOH$

Tuliskan tiga produk dari hidrolisis senyawa berikut?

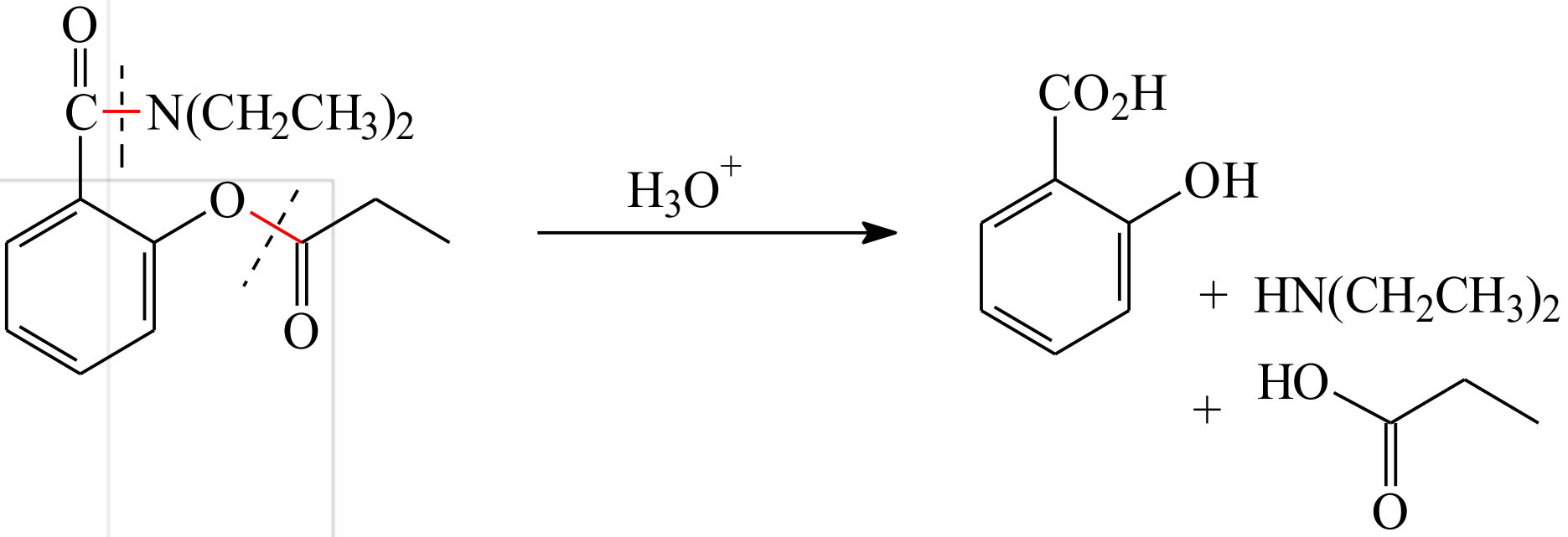




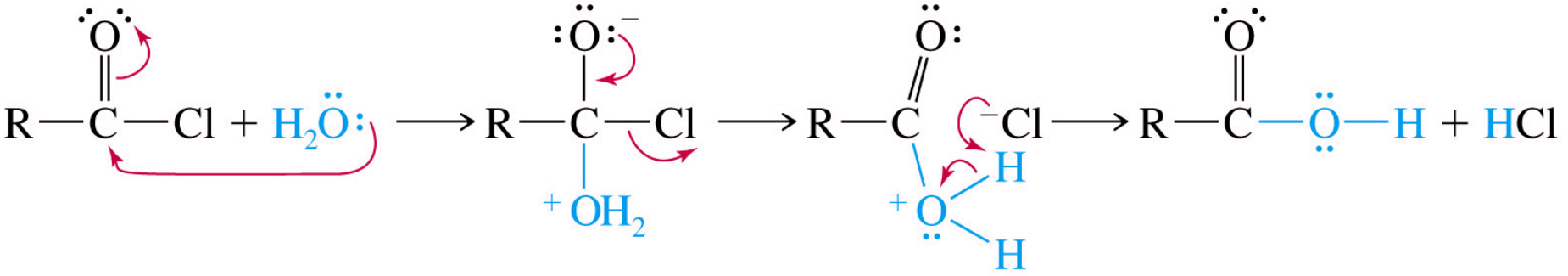
products are carboxylic acid(s) + conjugate acid of the LGs

Two hydrolyzable groups

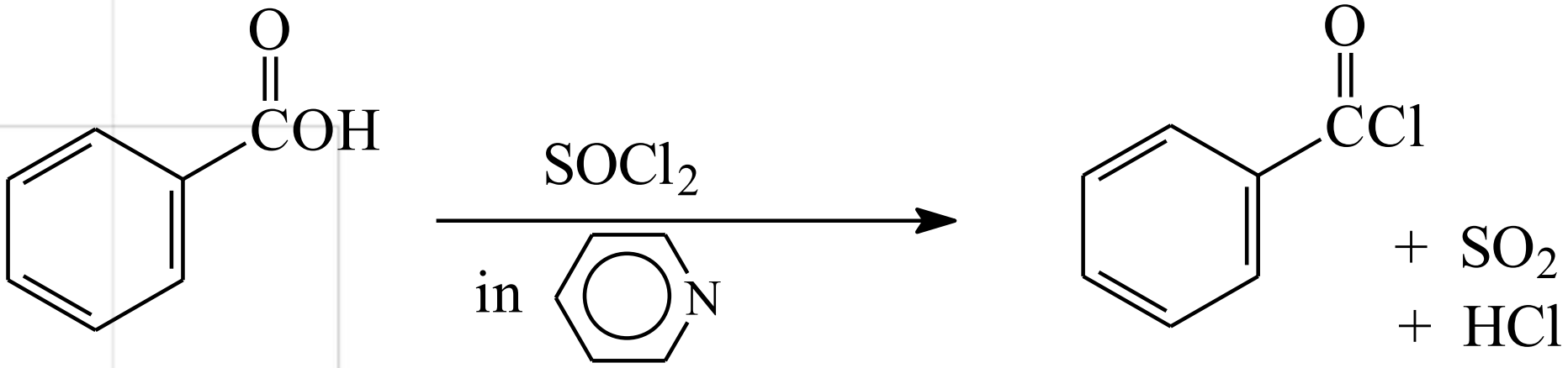
Produk Hidrolisis

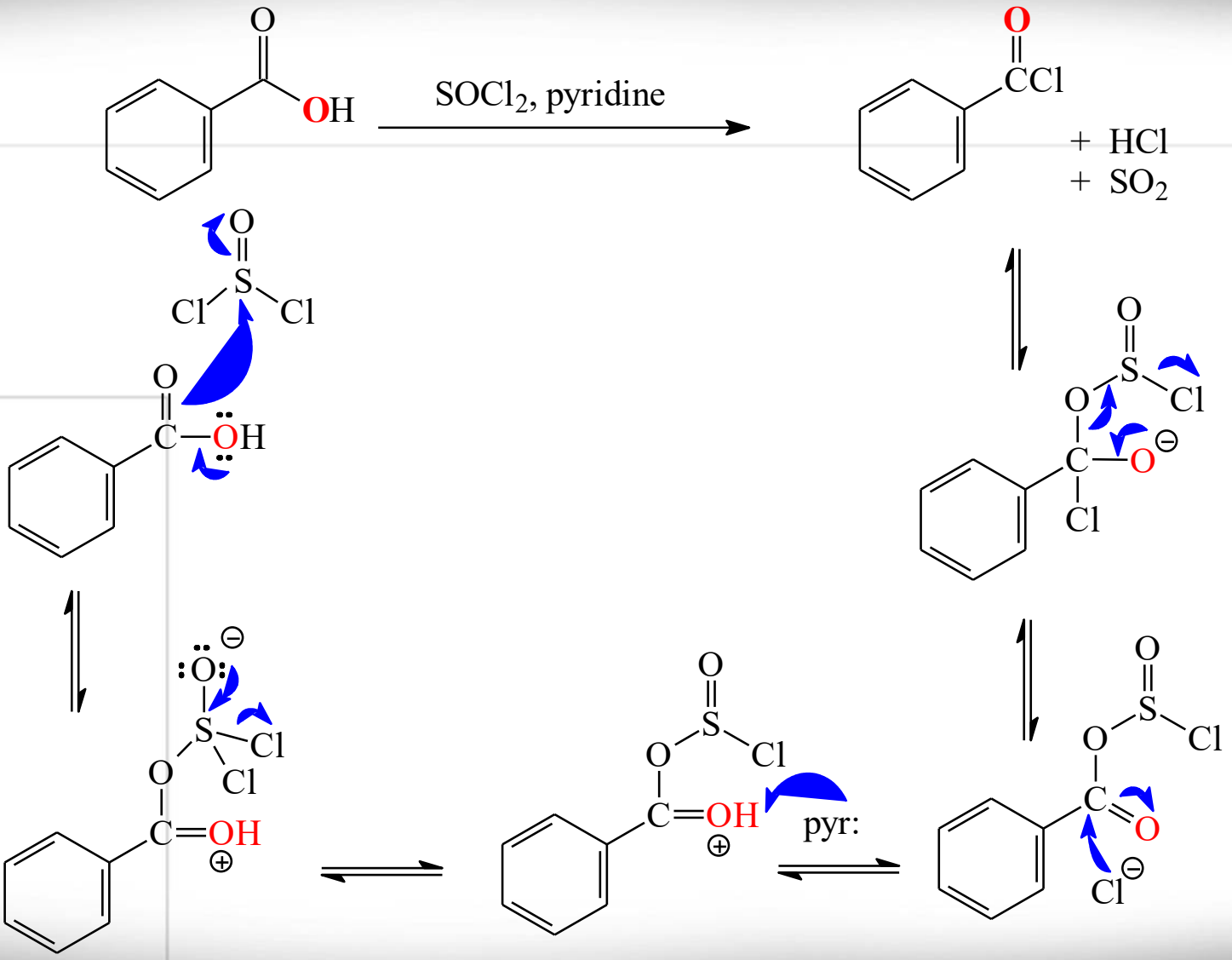


Hidrolisis of klorida asam

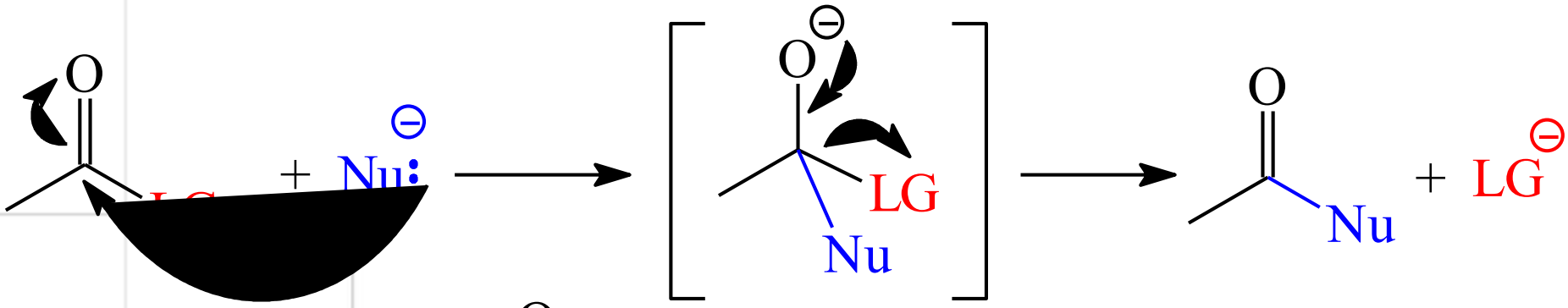


Pembuatan klorida asam




SOCl2, pyridine
+ HCl
+ SO2
pyr:

Substitusi Nukleofilik

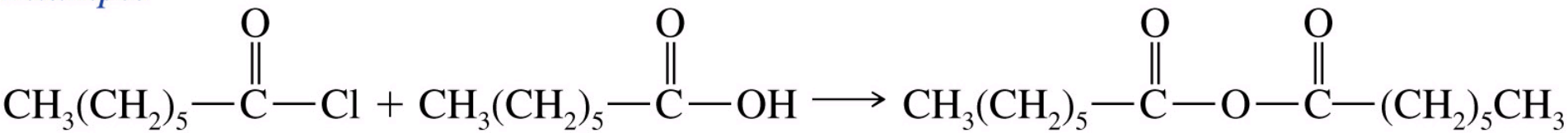


$$LG = \overset{\ominus}{Cl}\ ,\ \overset{\ominus}{O}\overset{\ominus}{C}\overset{O}{\overset{\|}{C}}H_3\ ,\ \overset{\ominus}{O}CH_3\ ,\ \overset{\ominus}{N}H_2$$

best worst

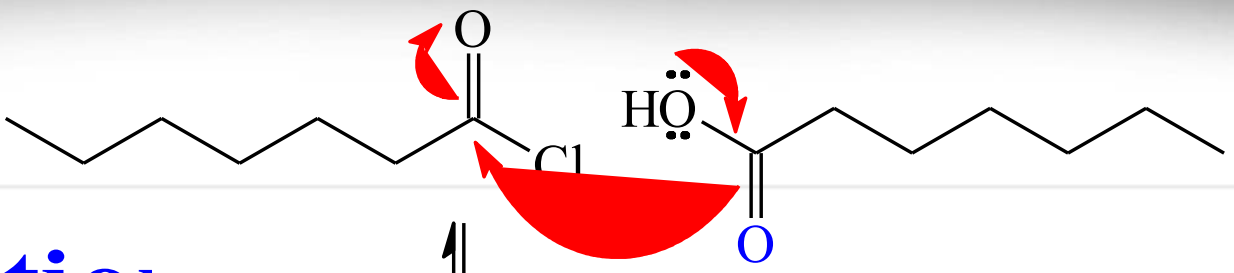
Pembuatan asam anhidrida menggunakan klorida asam dilakukan tanpa menggunakan katalis

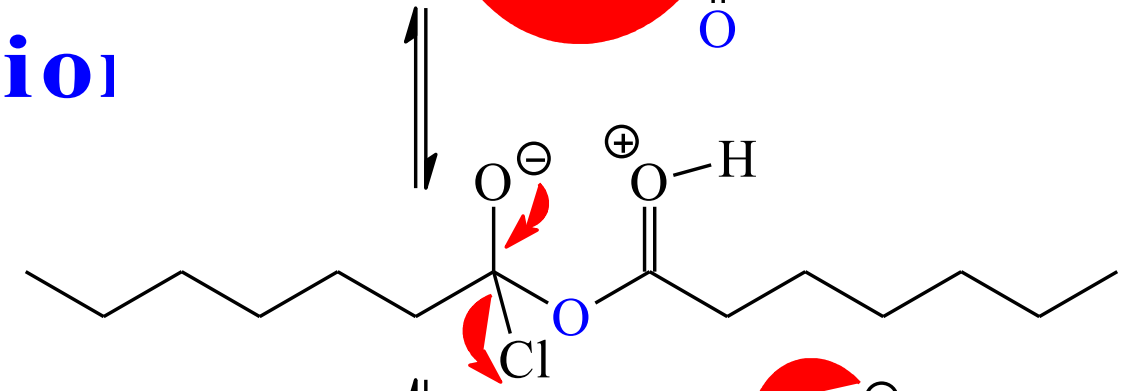
Example



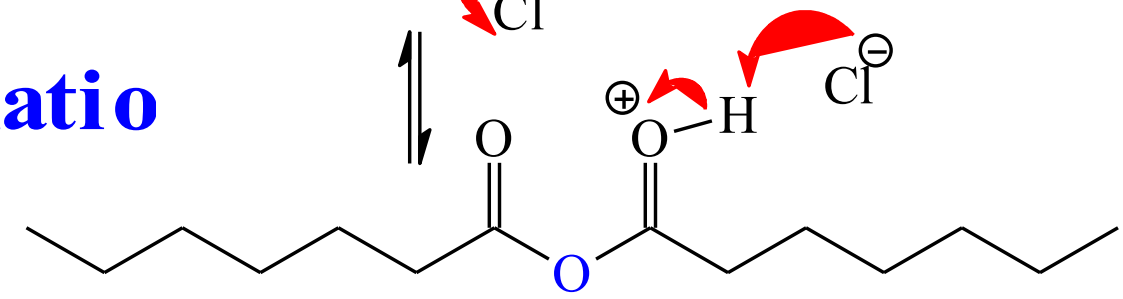
heptanoyl chloride — heptanoic acid — heptanoic anhydride

addition

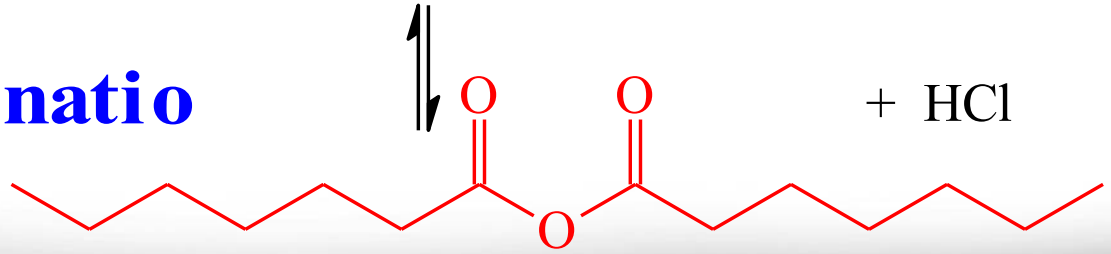




eliminatio

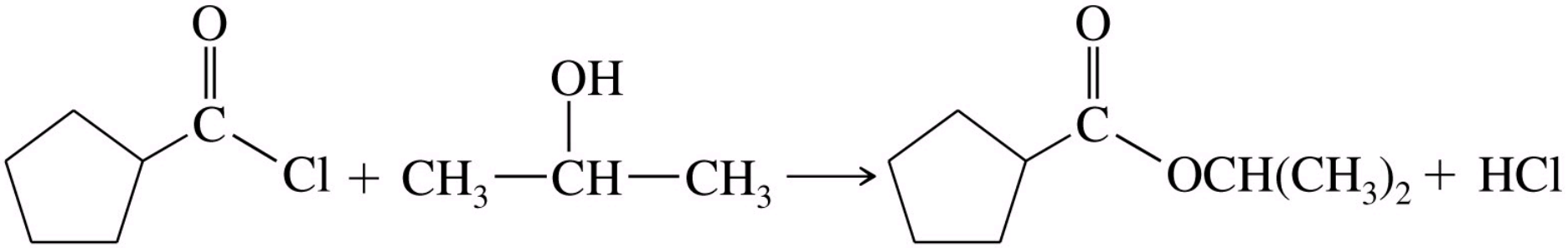


deprotonatio



Sintesis ester dari klorida asam

Example

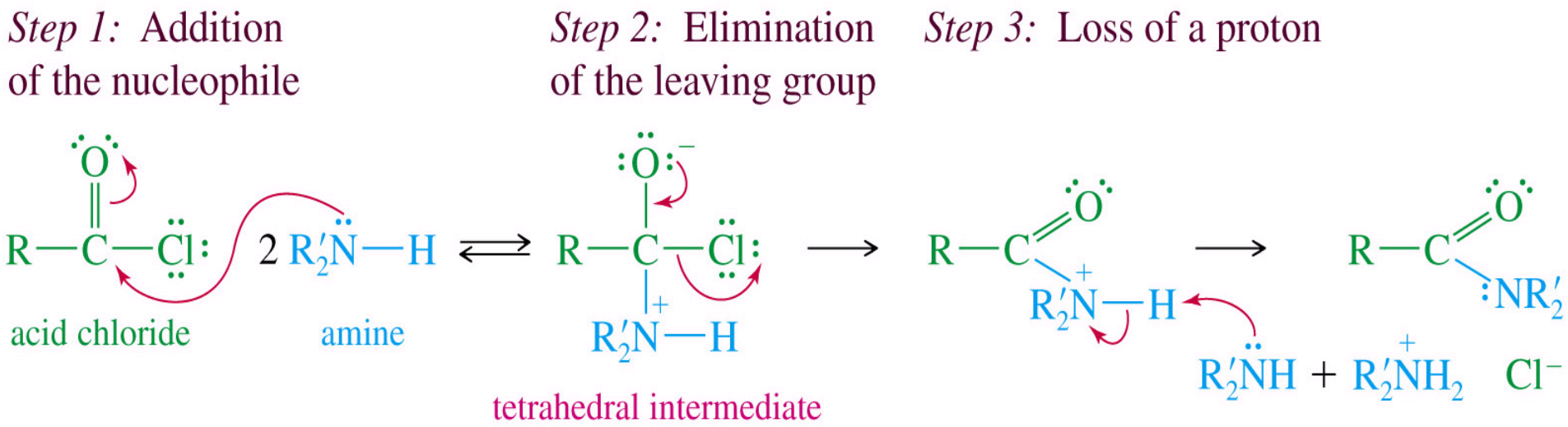


cyclopentanecarbonyl chloride

2-propanol

2-propyl cyclopentanecarboxylate

Sintesis amida dari klorida asam

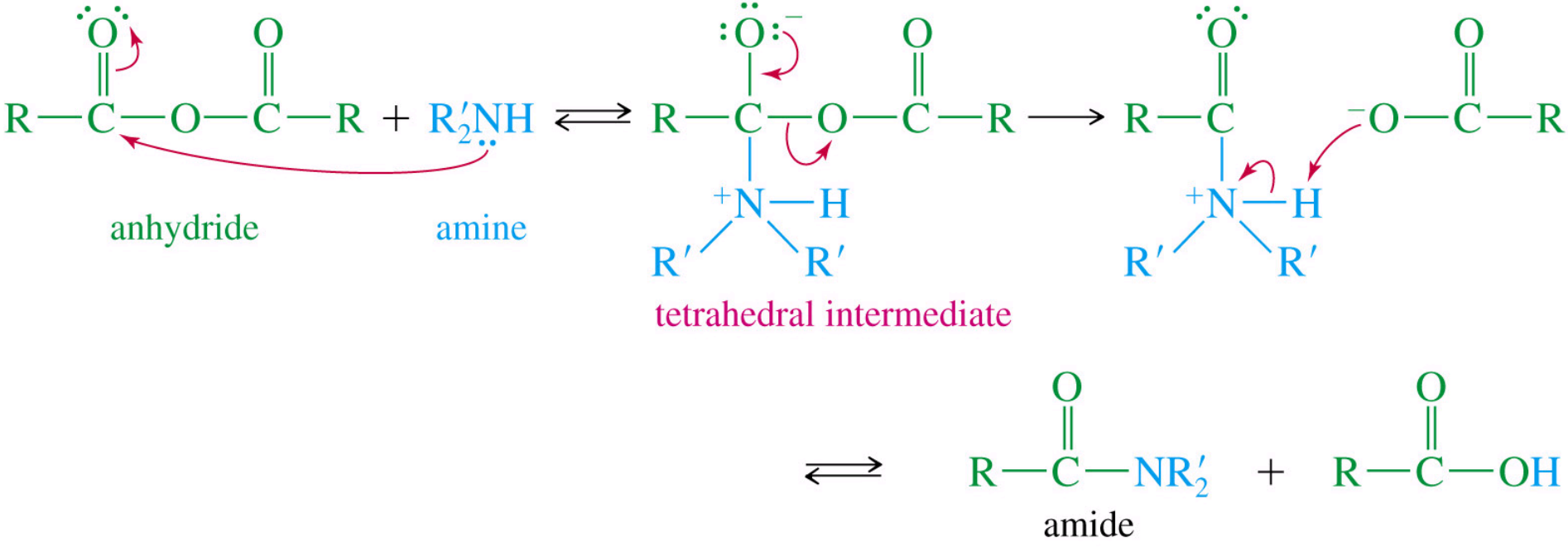


Amida dari anhidrida

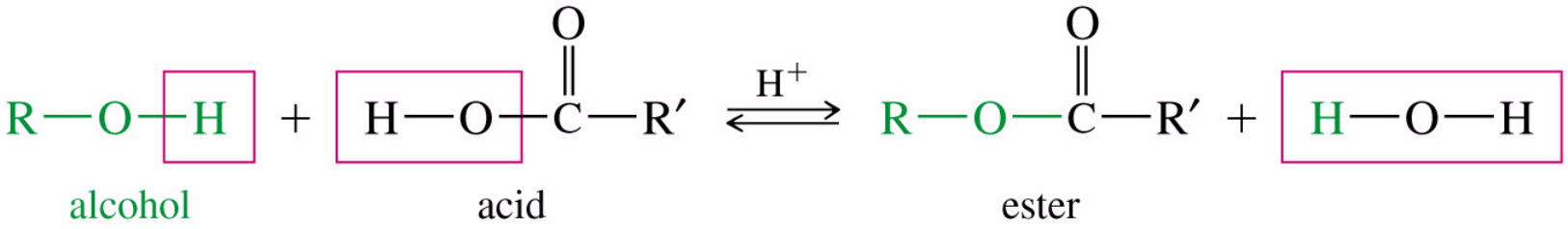
Step 1: Addition of the nucleophile

Step 2: Elimination of the leaving group

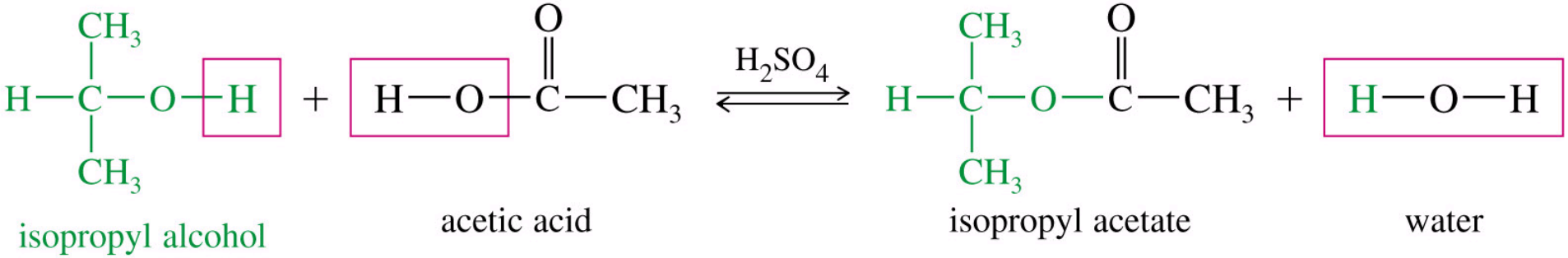
Step 3: Loss of a proton



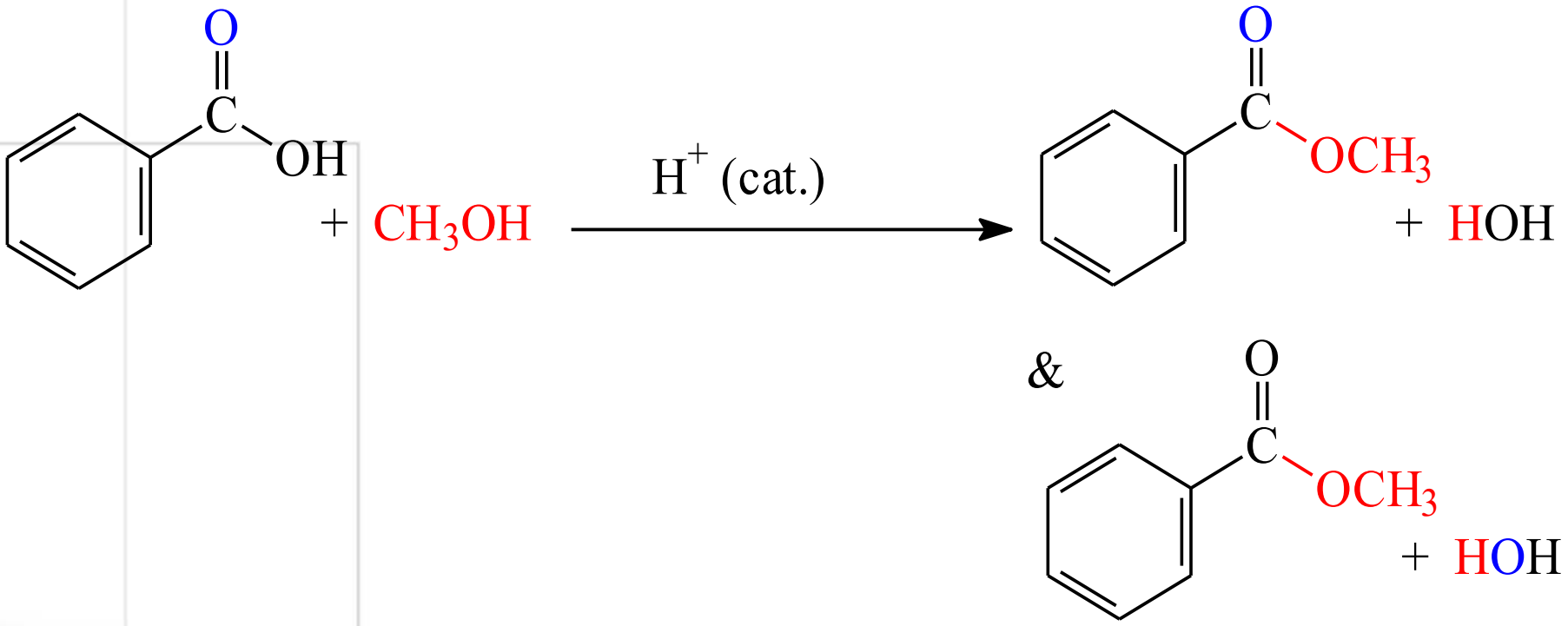
Esterifikasi

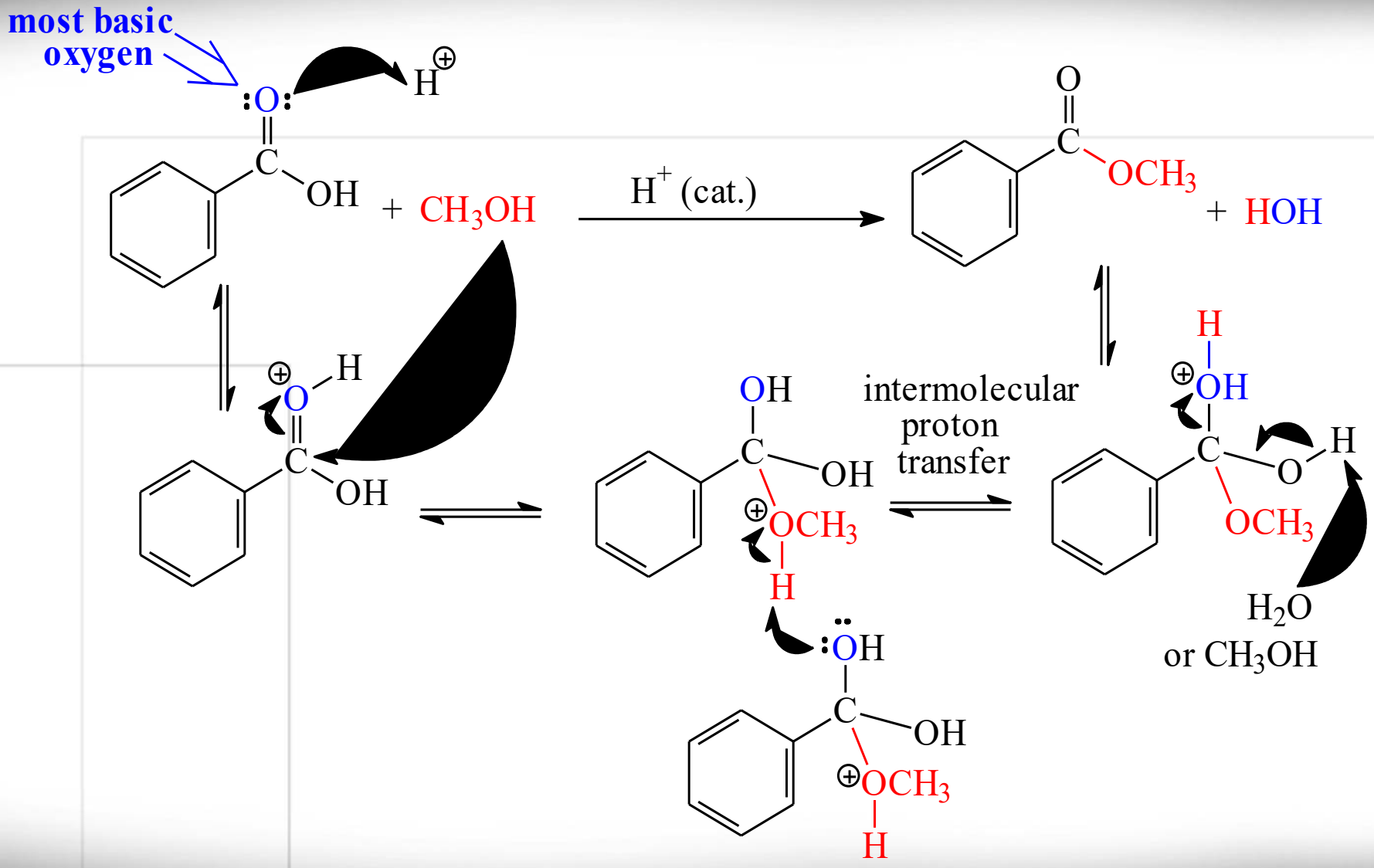


Example

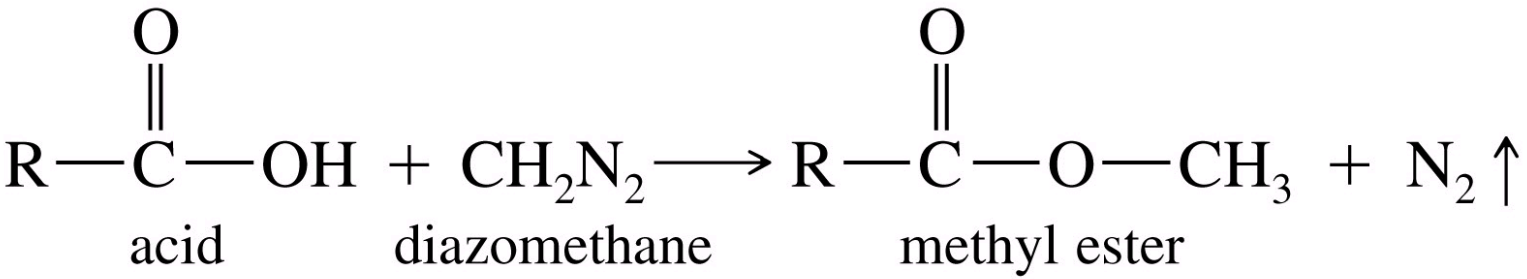


Mekanisme esterifikasi menunjukkan bahwa atom O pada gugus ester berasal dari alkohol

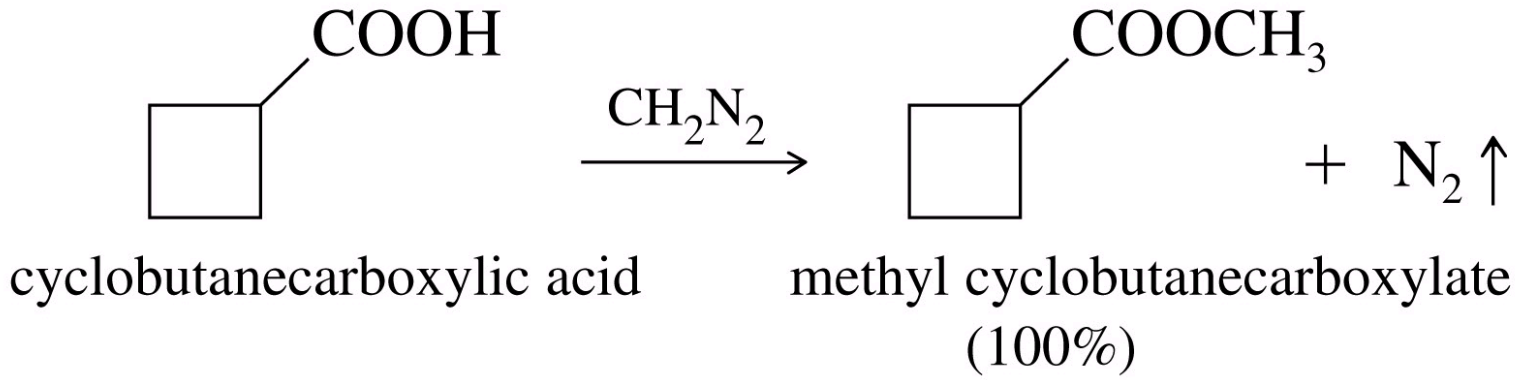



most basic oxygen
H+
+ CH3OH
H+ (cat.)
+ HOH
intermolecular proton transfer
H2O
or CH3OH

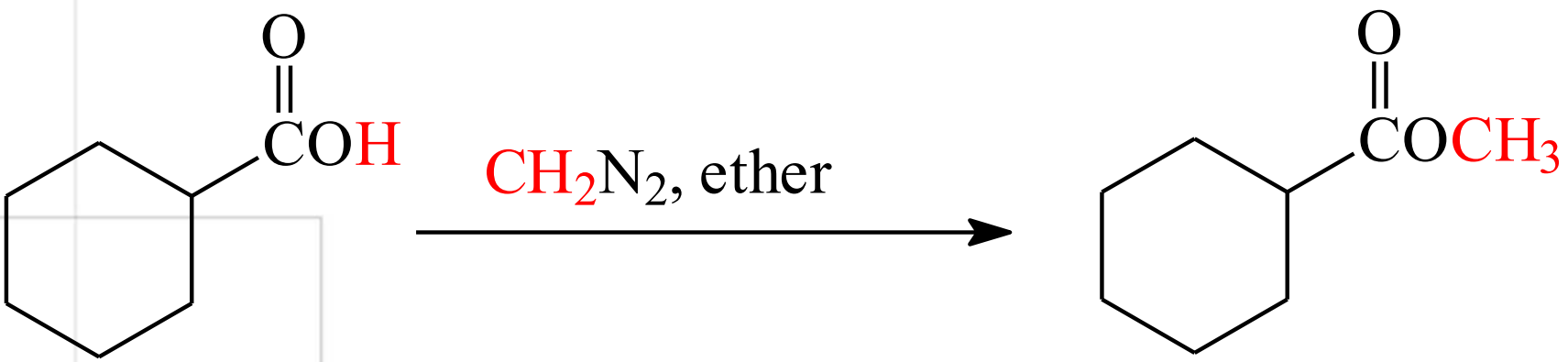
Sintesis metil ester menggunakan diazometana

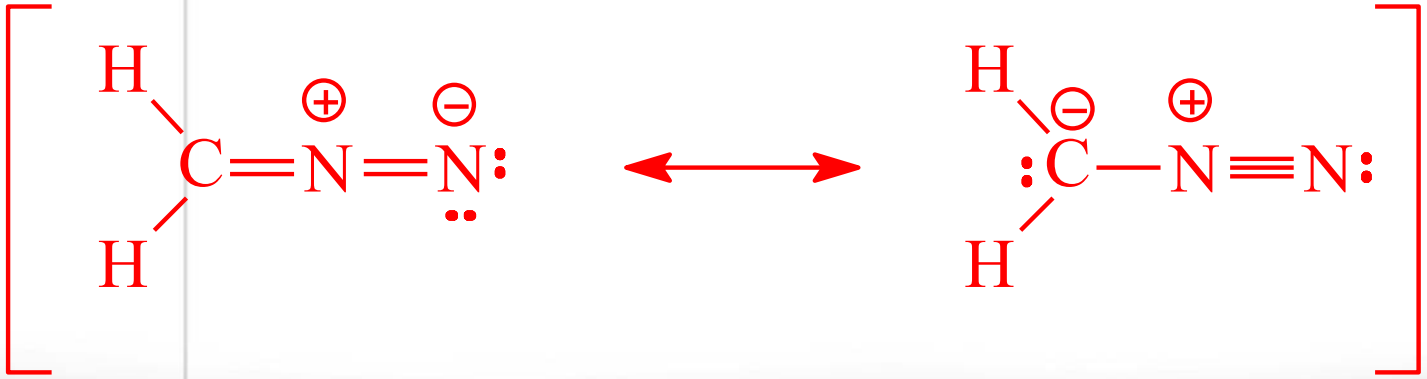


Example



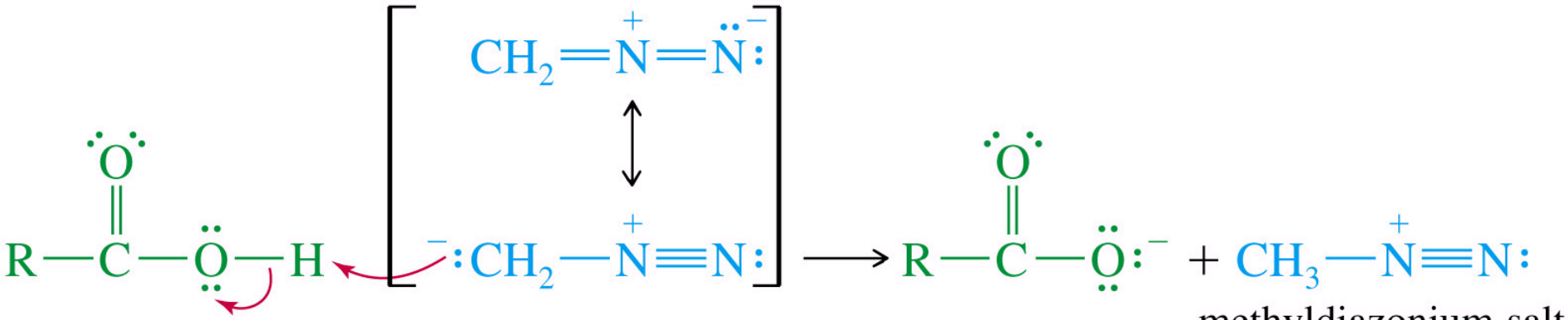
Diazometana sebagai karbon basa



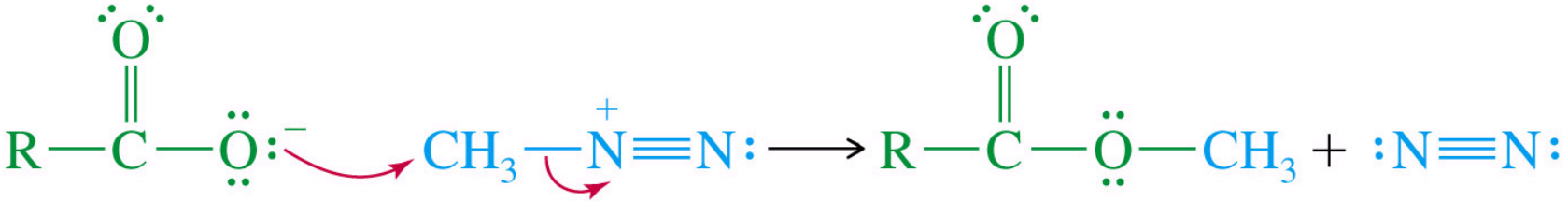


Mekanisme

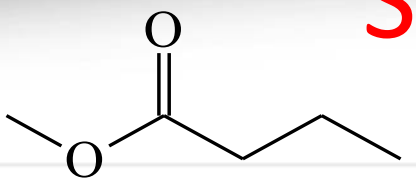
Step 1: Proton transfer



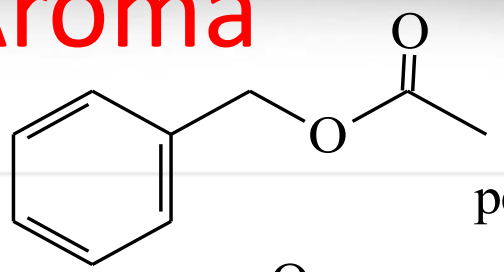
Step 2: Nucleophilic attack on the methyl group



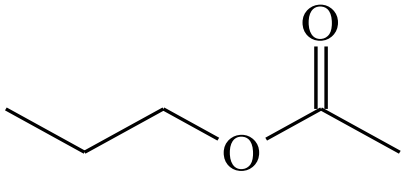
Senyawa Aroma



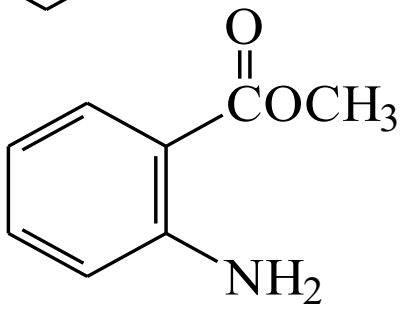
apple



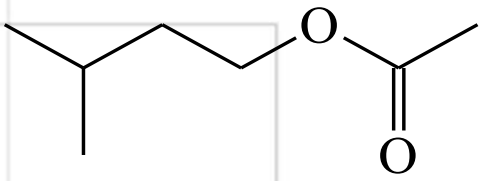
peach



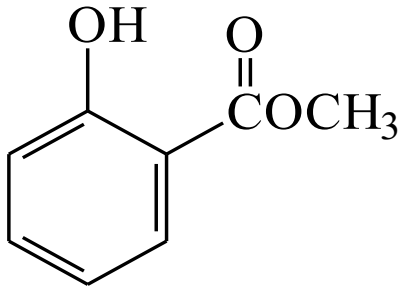
pear



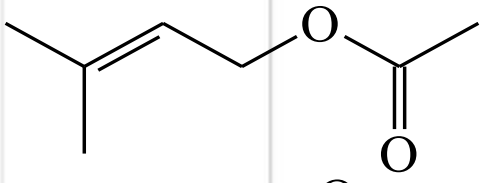
grape



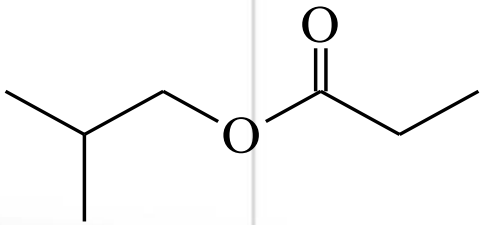
banana



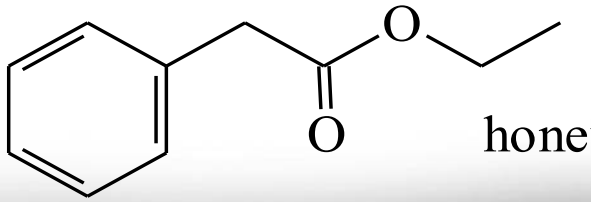
wintergreen



"juicy fruit"



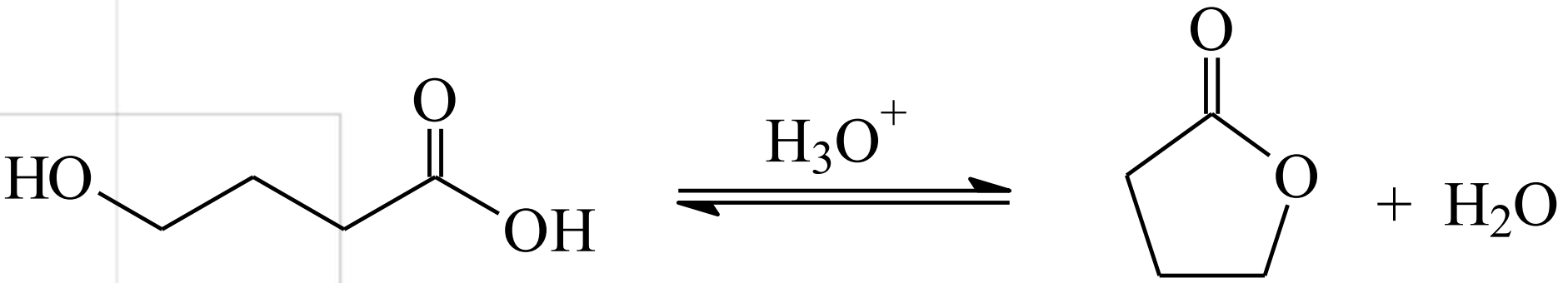
rum

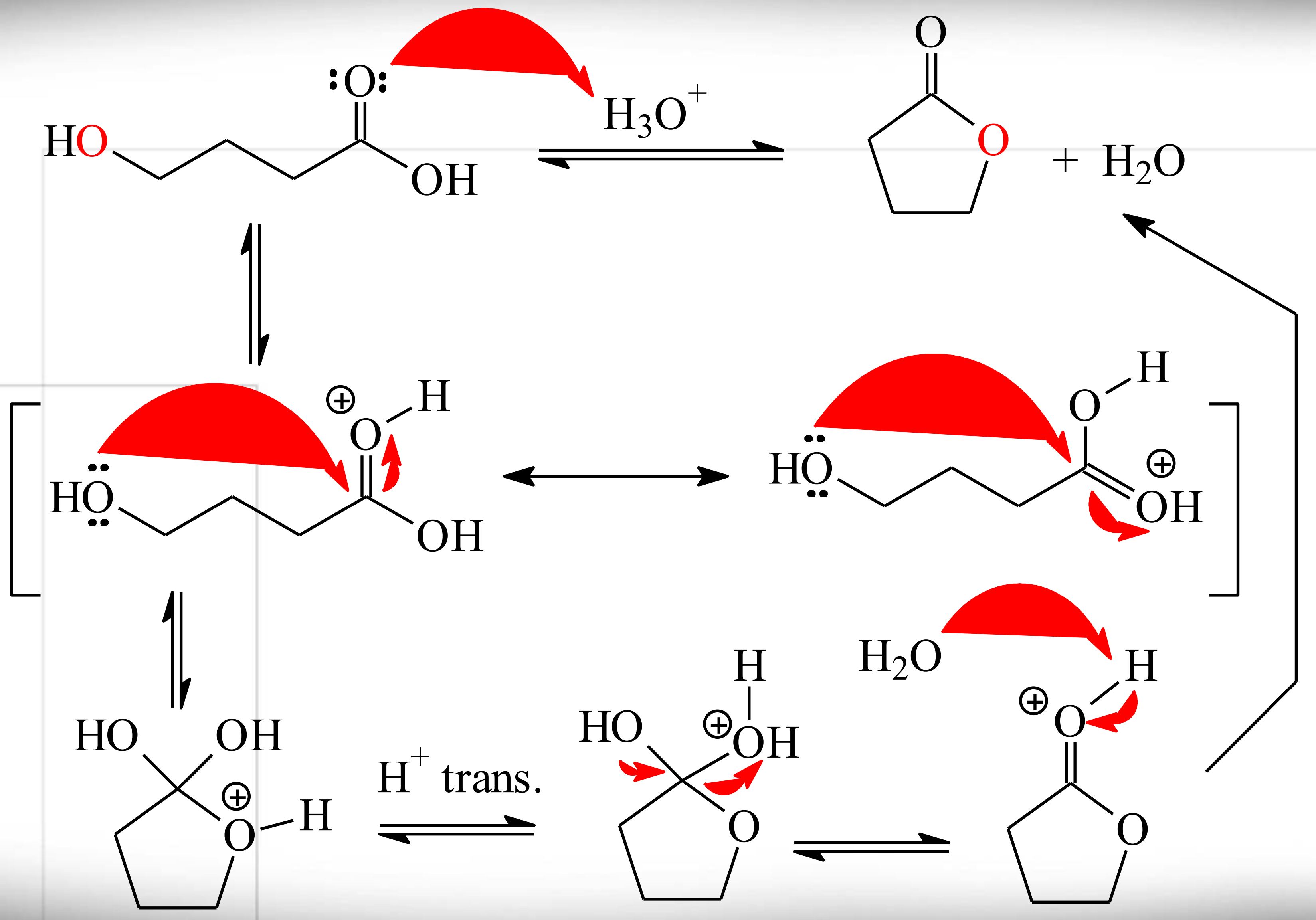


honey

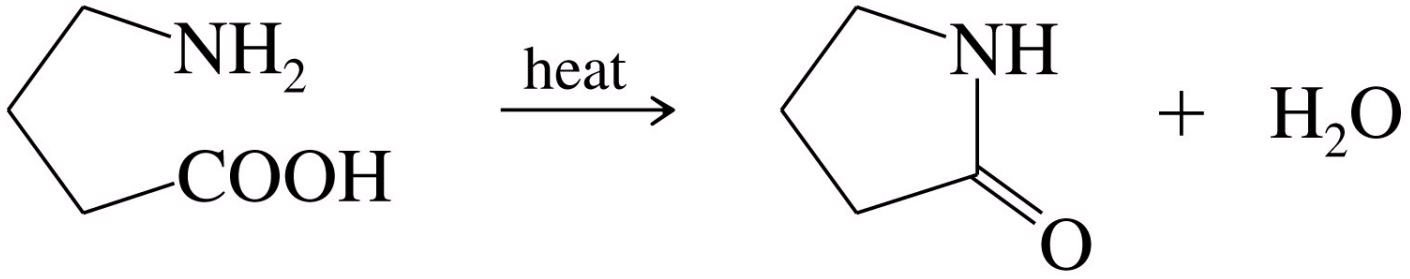
orange

Esterifikasi intramolekular

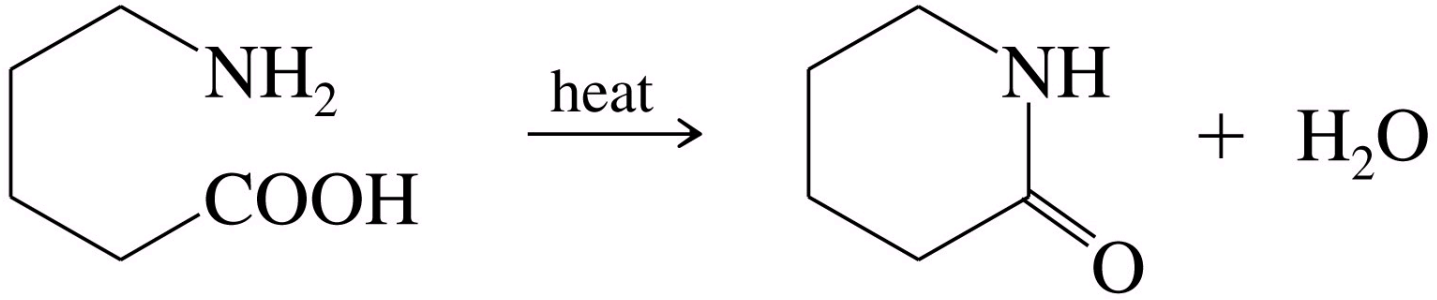



HO
:O:
OH
H_3O^+
O
O
+ H_2O
H
O
HO
OH
H
O
HO
OH
HO
OH
O
H
H+ trans.
HO
H
OH
O
H_2O
H
O
O

Pembentukan Laktam (amida siklis)

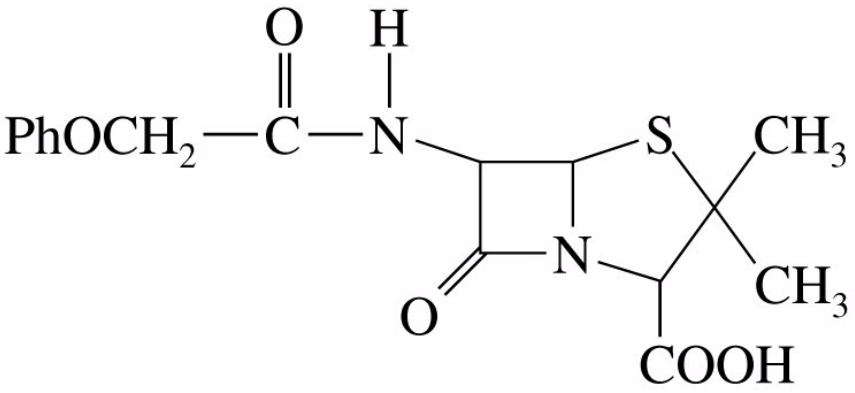


γ-aminobutyric acid γ-butyrolactam

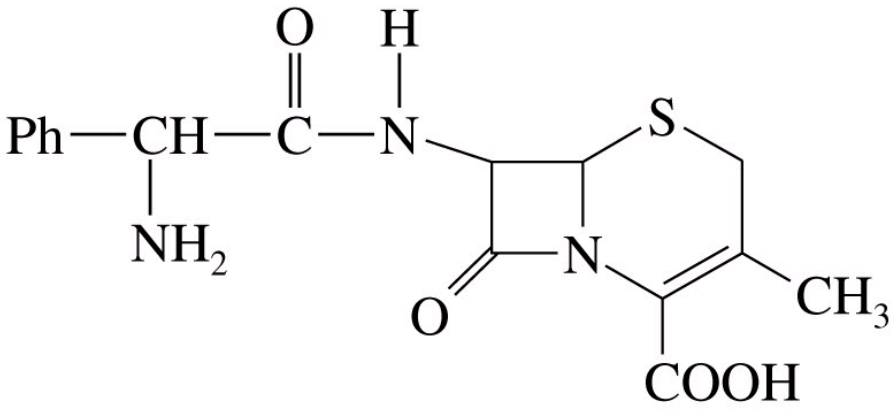


δ-aminovaleric acid δ-valerolactam

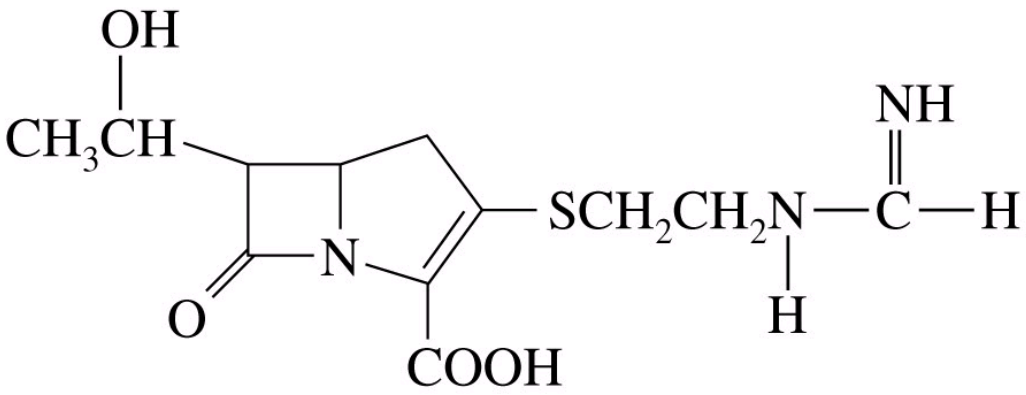
β-Laktam sebagai antibiotik



penicillin V
a penicillin

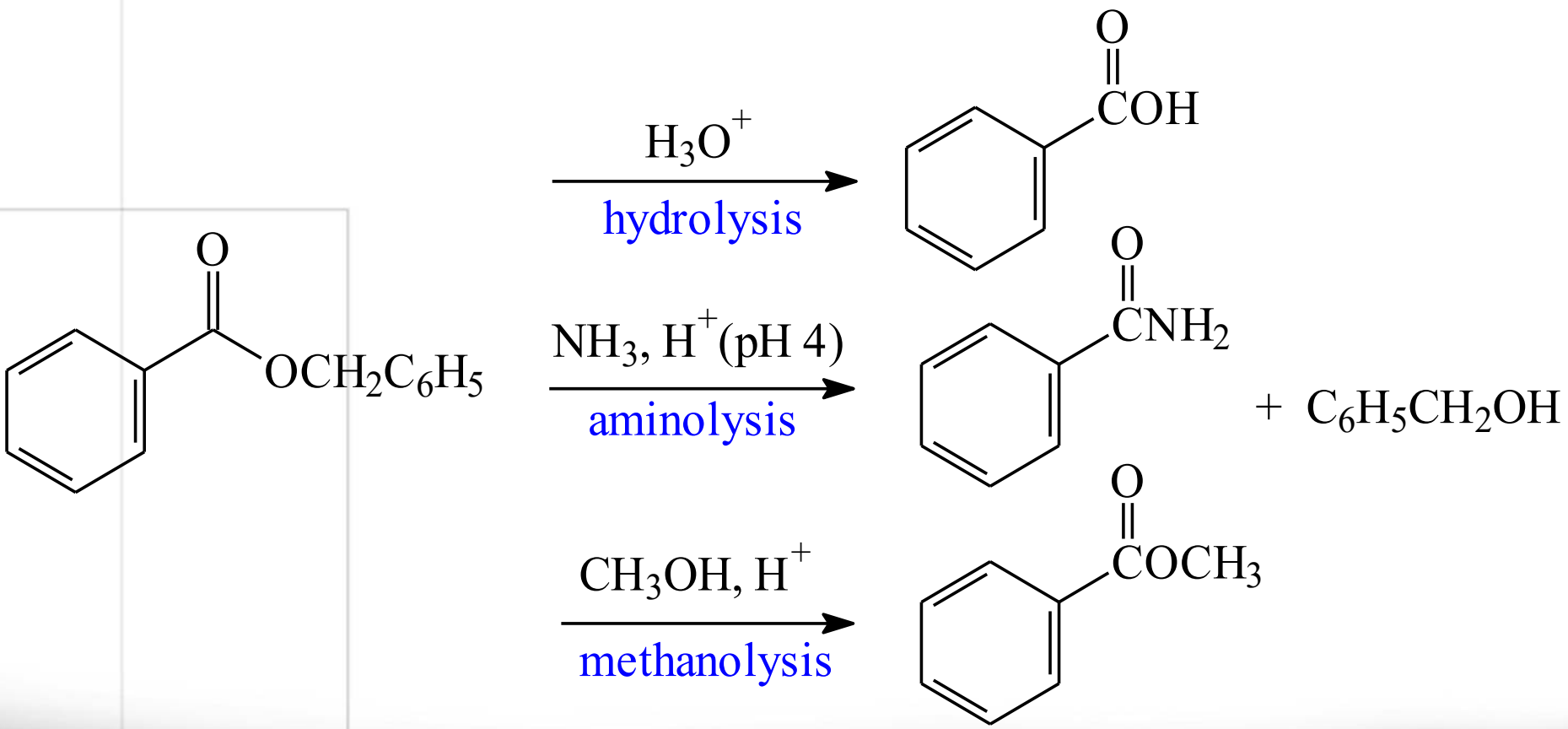


cephalexin (Keflex®)
a cephalosporin

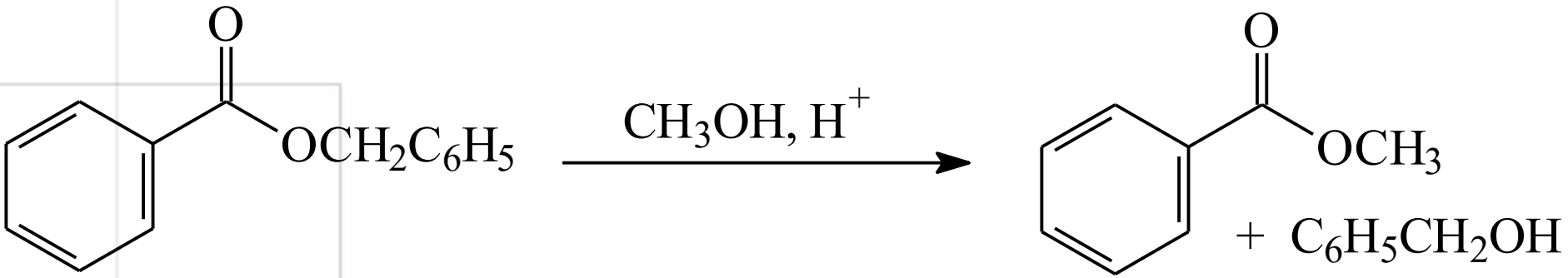


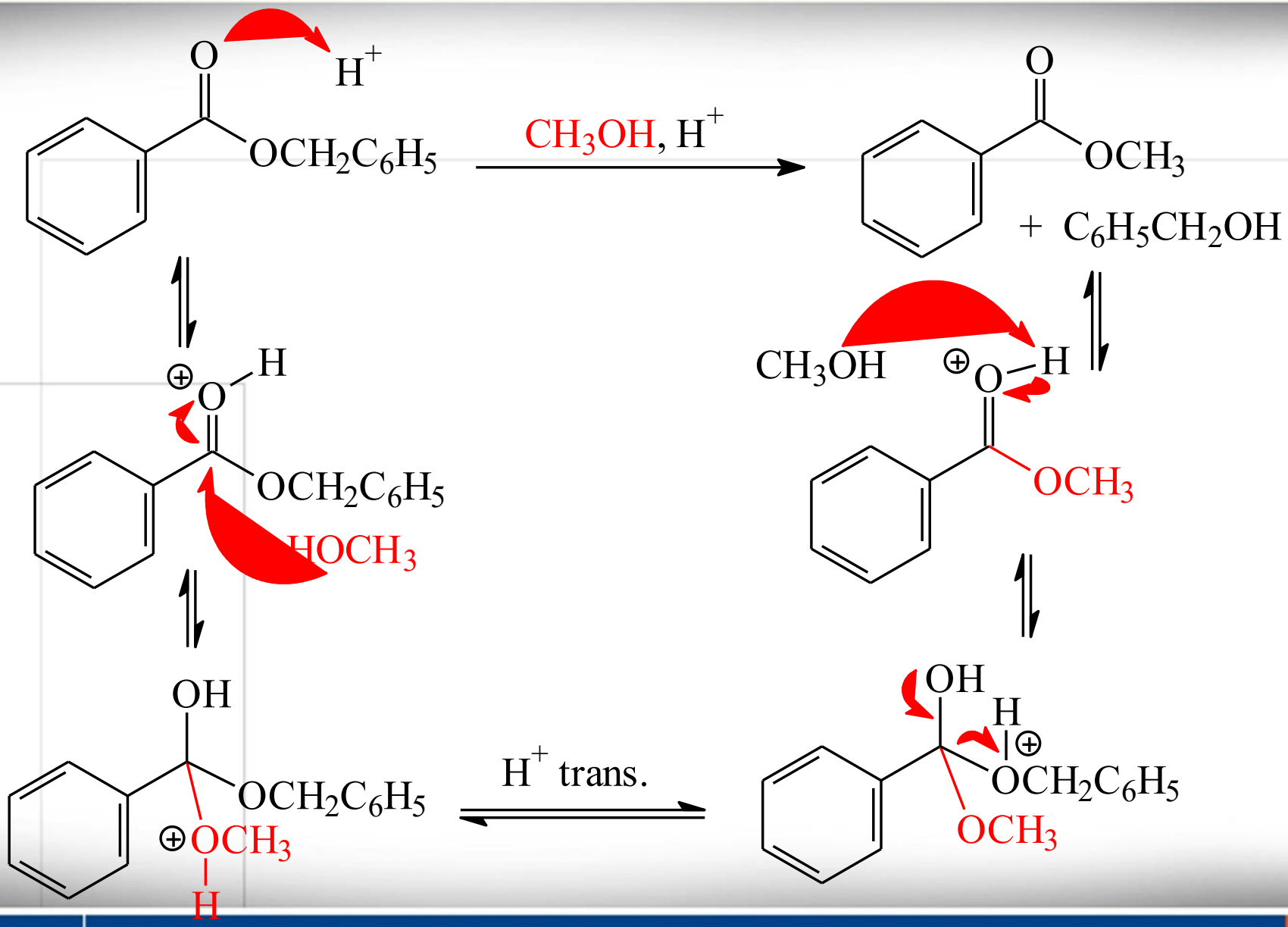
imipenem (Primaxin®)
a carbapenem

Reaksi terkatalisis asam

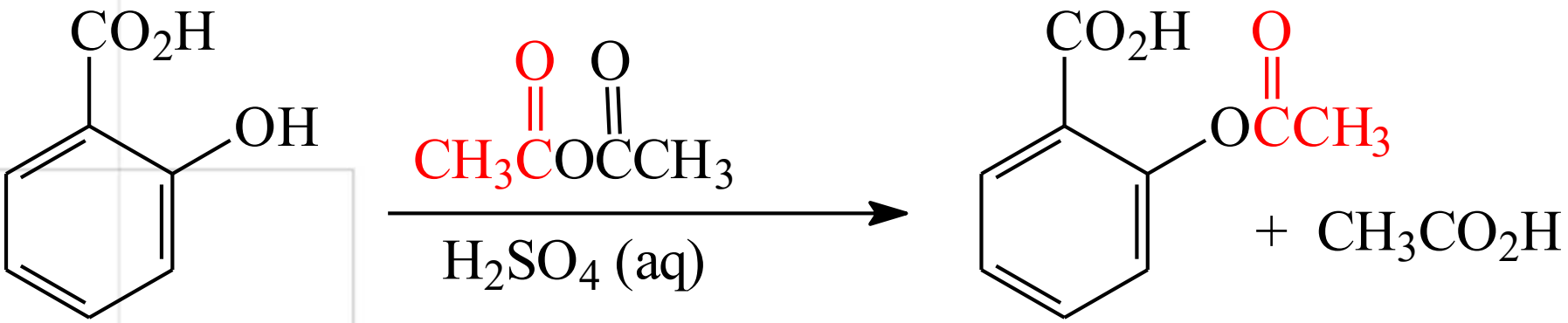


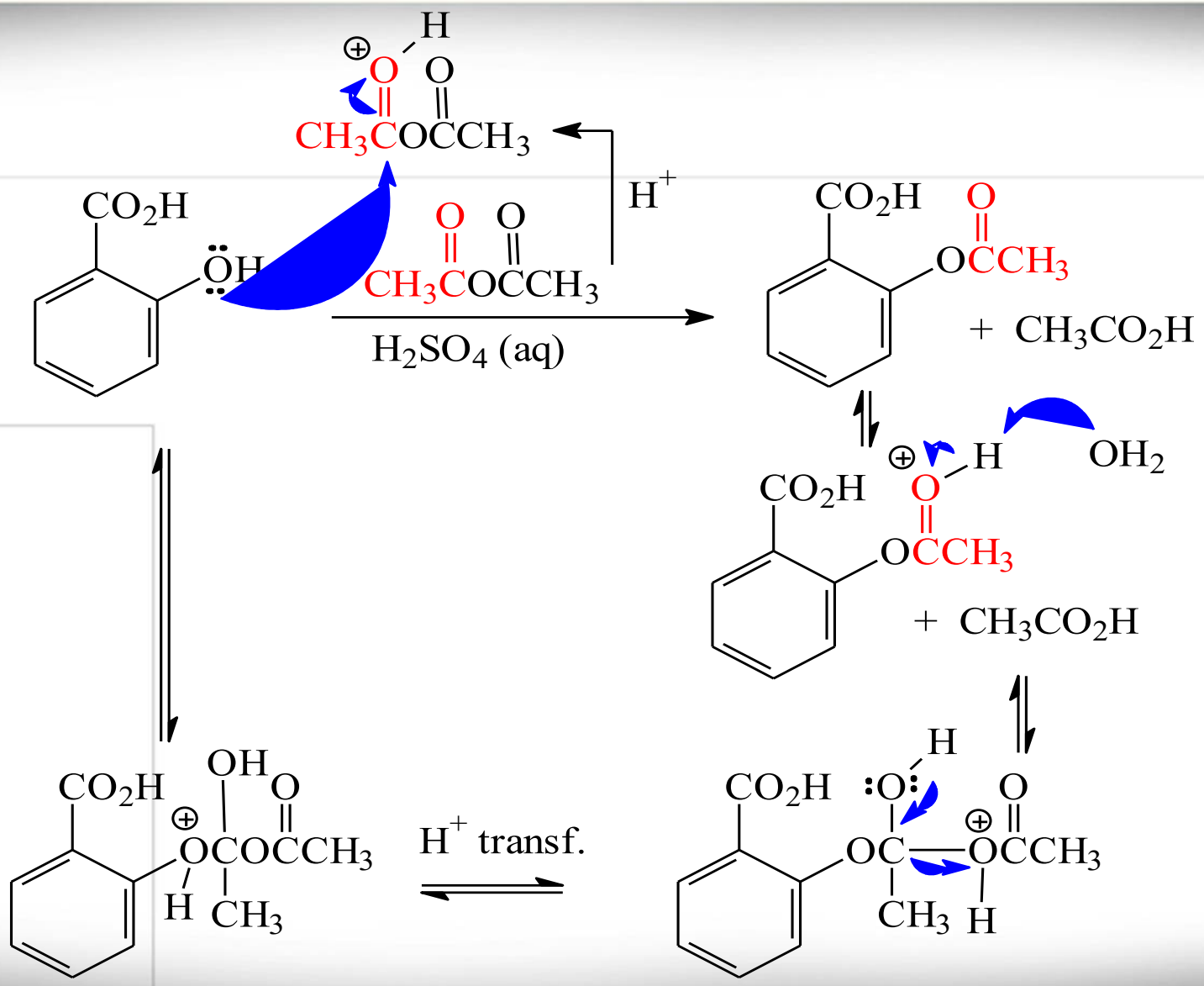
Transesterifikasi



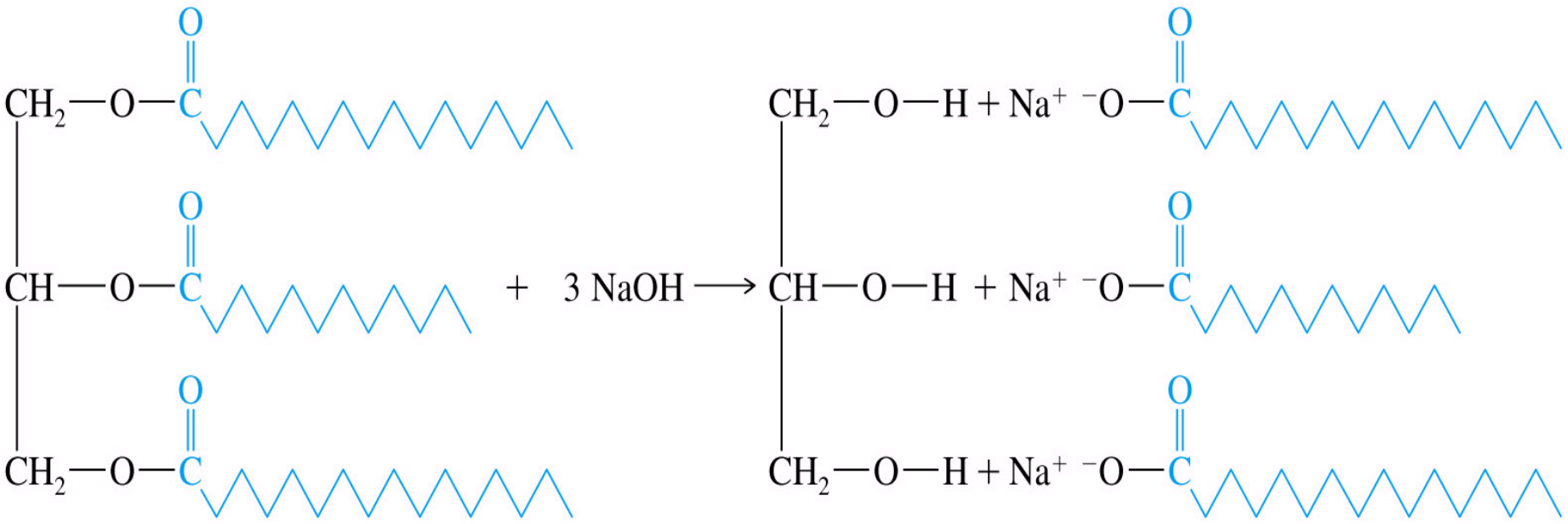

O
H+
OCH2C6H5
CH3OH, H+
OCH3
+ C6H5CH2OH
CH3OH
H
OCH3
HOCH3
OH
H
OCH3
H+ trans.

Sintesis Aspirin



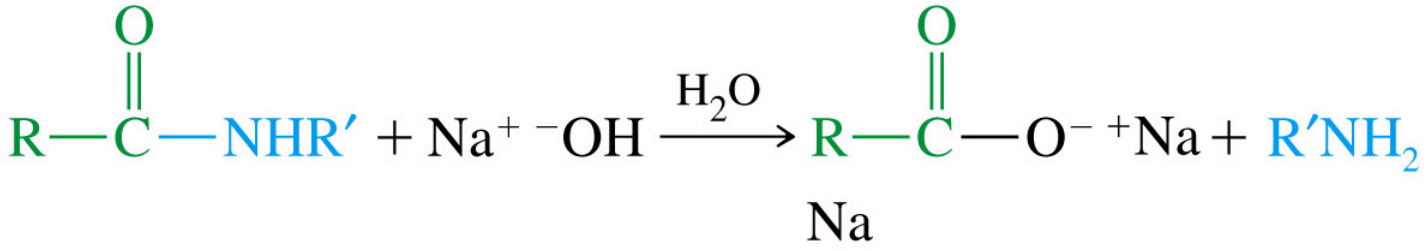

H
O
O
CH3COCCH3
CO2H
OH
O
O
CH3COCCH3
H+
H2SO4 (aq)
CO2H
O
OCCH3
+ CH3CO2H
H
OH2
CO2H
O
OCCH3
+ CH3CO2H
CO2H
OH
O
OCOCCH3
H
CH3
H+ transf.
H
CO2H
:O:
O
OC
OCCH3
CH3
H

Hidrolisis terkatalis asam

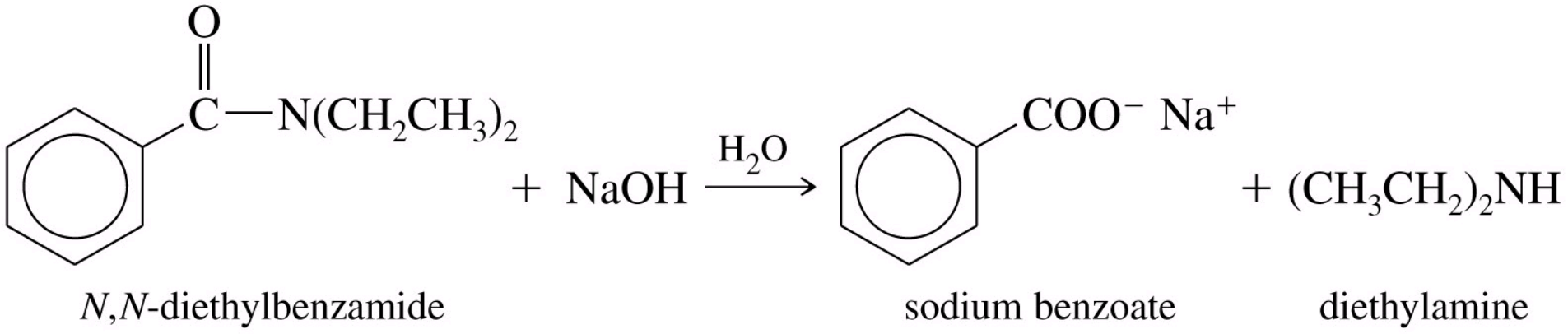


Hidrolisis amida terkatalis basa

Basic hydrolysis



Example

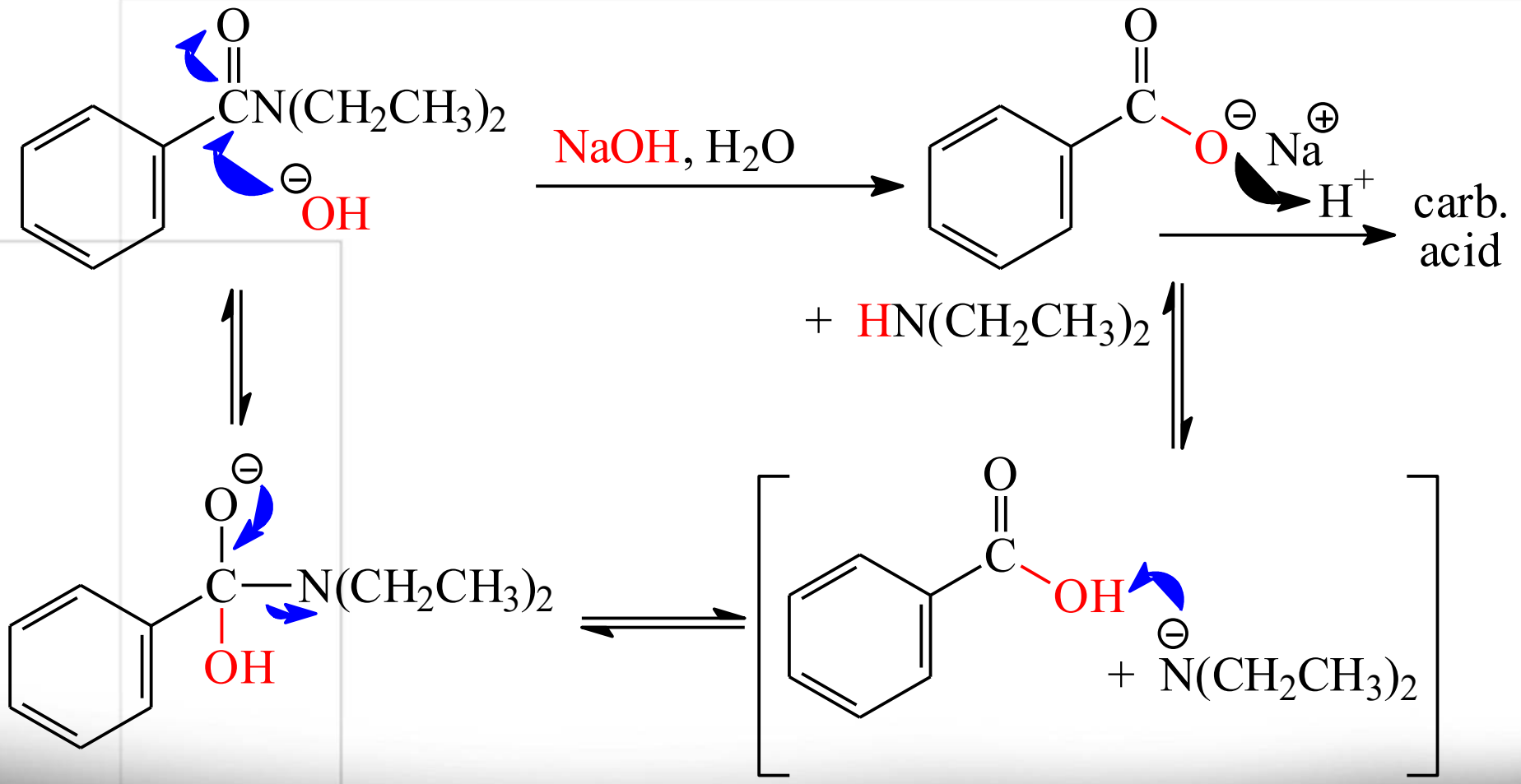


N,*N*-diethylbenzamide

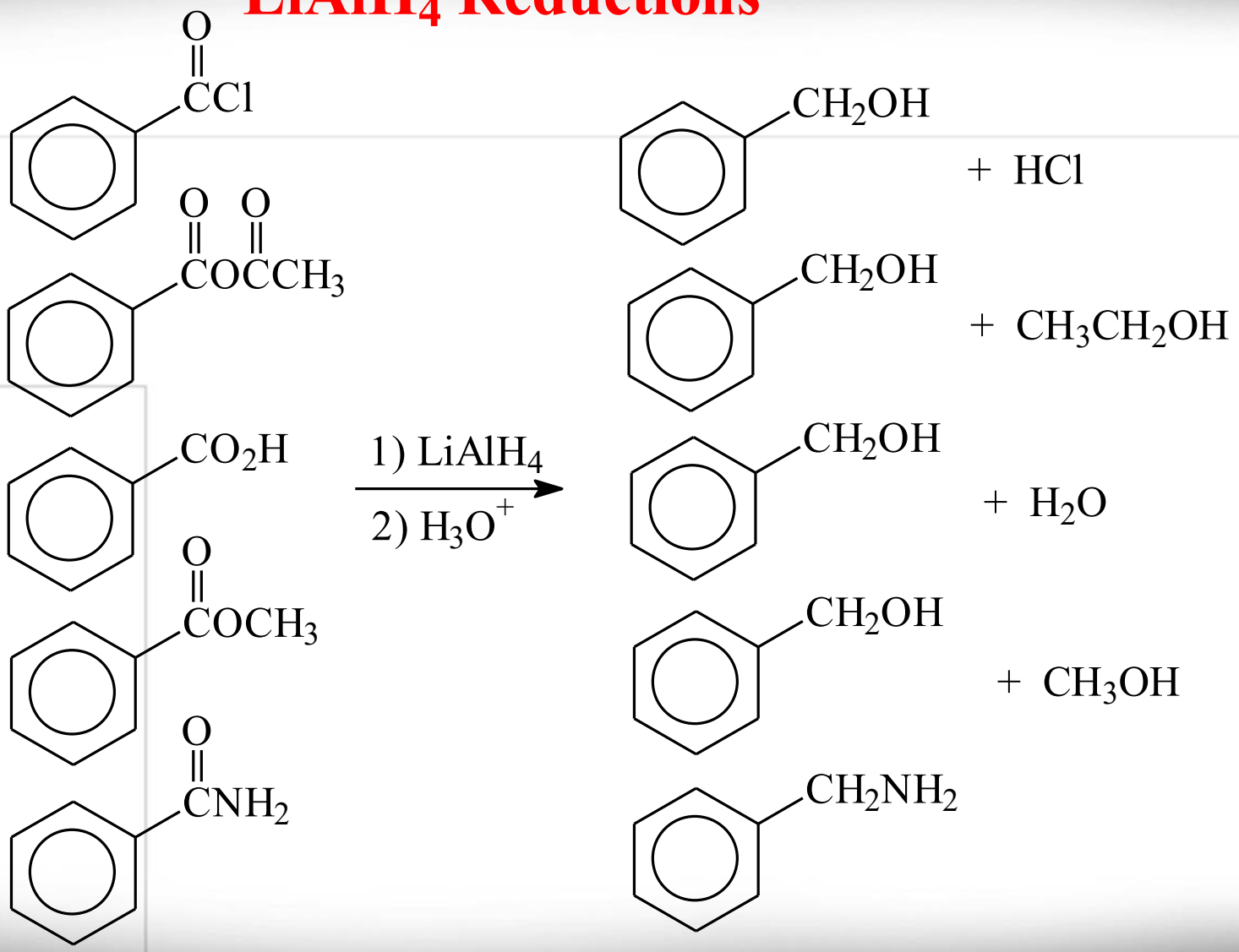
sodium benzoate

diethylamine

Mekanisme


CN(CH2CH3)2
OH
NaOH, H2O
Na
H+
carb. acid
+ HN(CH2CH3)2
C—N(CH2CH3)2
OH
OH
+ N(CH2CH3)2

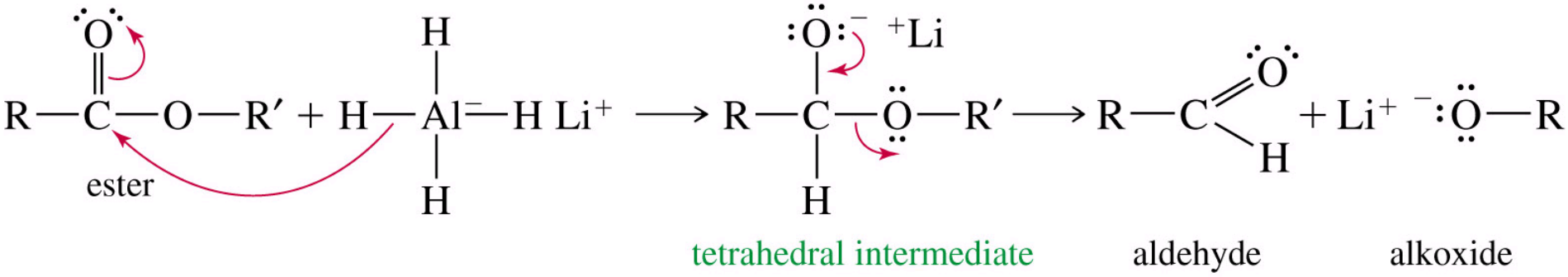
$LiAlH_4$ Reductions



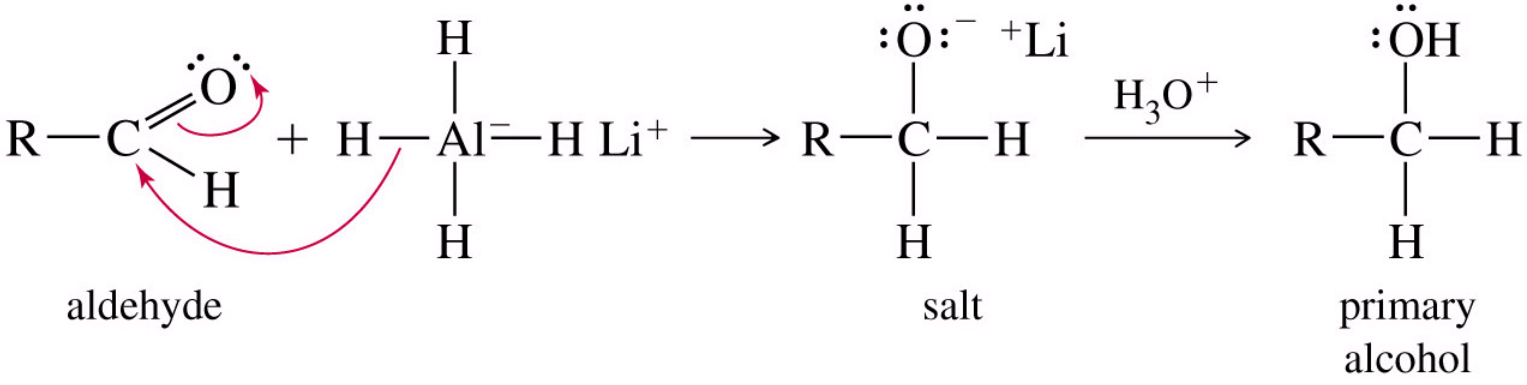
Reduksi ester dengan $LiAlH_4$

Step 1: Addition of the nucleophile (hydride)

Step 2: Elimination of alkoxide



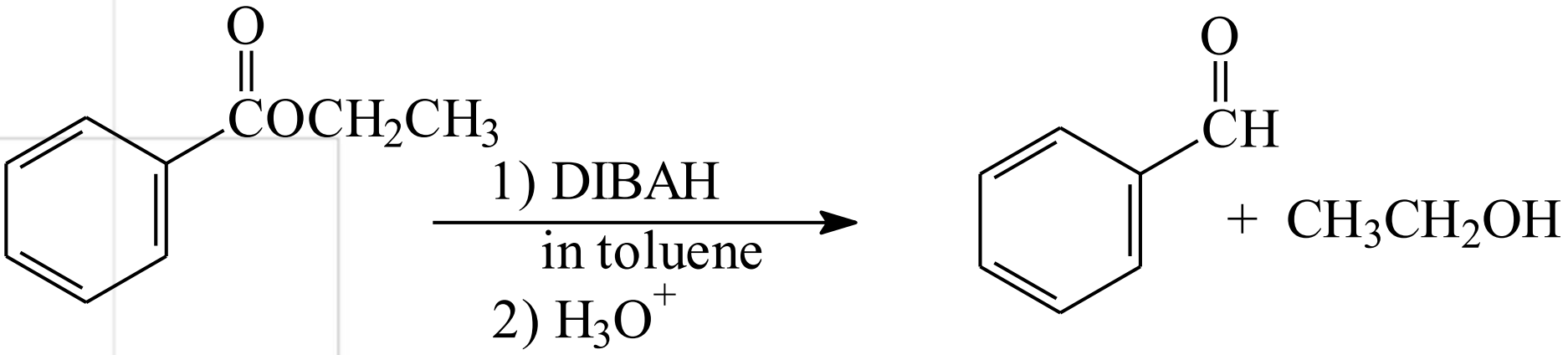
Step 3: Addition of a second hydride ion



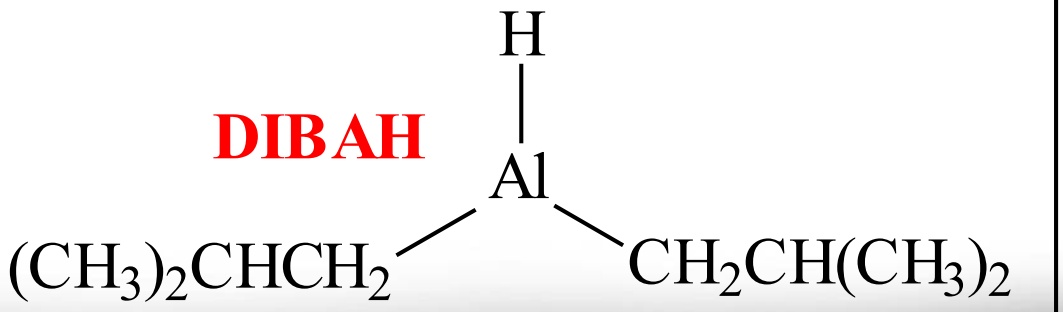
DIBAL-H

Diisobutil Aluminum Hidrida

Reduction of an Ester to an Aldehyde



DIBAH



Sekian