



FAKULTAS FARMASI
UNIVERSITAS PANCASILA

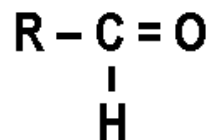
MODUL PEMBELAJARAN KIMIA ORGANIK D3

SENYAWA KARBONIL, ASAM KARBOKSILAT DAN TURUNANNYA

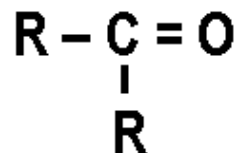
SENYAWA KARBONIL

□ Senyawa dengan gugus karbonil $\begin{array}{c} -\text{C} = \text{O} \\ | \end{array}$

■ Aldehid



■ Keton



Dimana R = gugus alkil

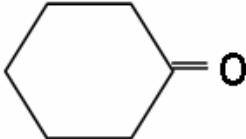
■ Tata Nama Aldehid :

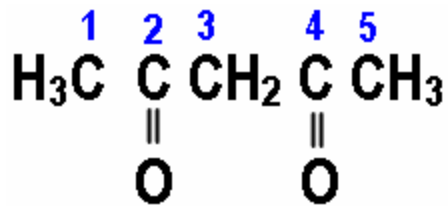
- IUPAC : Huruf akhir – a pada alkana, diganti – al
- TRIVIAL : Berakhiran - aldehid

		IUPAC	TRIVIAL
1C	$\begin{array}{c} \text{H C} = \text{O} \\ \\ \text{H} \end{array}$	Metanal	formaldehid
2C	$\begin{array}{c} \text{H}_3\text{C} - \text{C} = \text{O} \\ \\ \text{H} \end{array}$	Etanal	asetaldehid
3C		Propanal	propionaldehid
4C		Butanal	butiraldehid
5C		Pentanal	valeraldehid
6C		Heksanal	kaproaldehid
7C		Heptanal	enantaldehid
8C		Oktanal	kaprialdehid
9C		Nonanal	pelargonaldehid
10C		Dekanal	kapraldehid

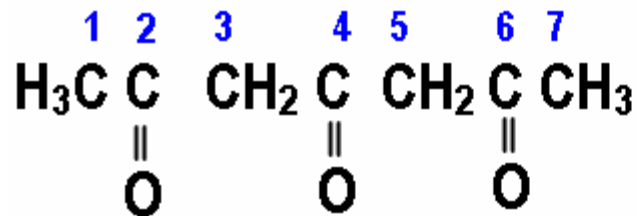
■ Tata Nama Keton

- IUPAC : Huruf akhir – a pada alkana, diganti -on
- TRIVIAL : Alkilketon

	IUPAC	TRIVIAL
$\begin{array}{c} \text{H}_3\text{C} - \text{C} - \text{CH}_3 \\ \\ \text{O} \end{array}$	propanon	dimetil keton (aseton)
$\begin{array}{c} \text{H}_3\text{CC} \text{ CH}_2 \text{ CH}_3 \\ \\ \text{O} \end{array}$	butanon	metiletil keton
	sikloheksanon	sikloheksil keton



2, 4 – pentanadion

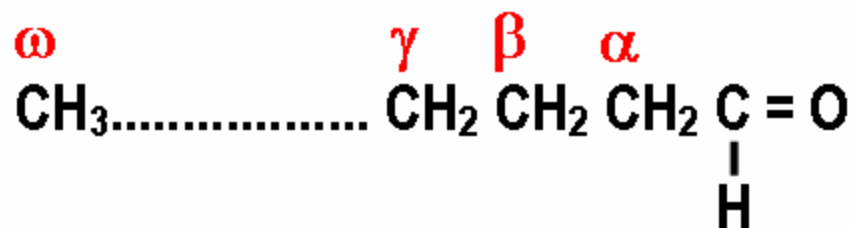


2,4,6 – heptanatrion

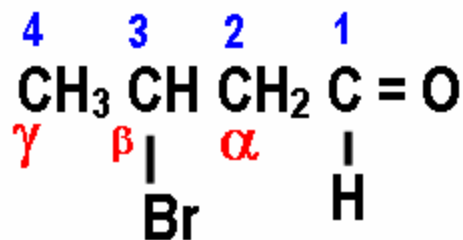


1, 4 – sikloheksanadion

- Atom C yang terdekat dengan atom C karbonil disebut C- α
- Atom C berikutnya β , γ , δ dst.
- C ujung suatu rantai panjang disebut atom C- ω



Contoh :



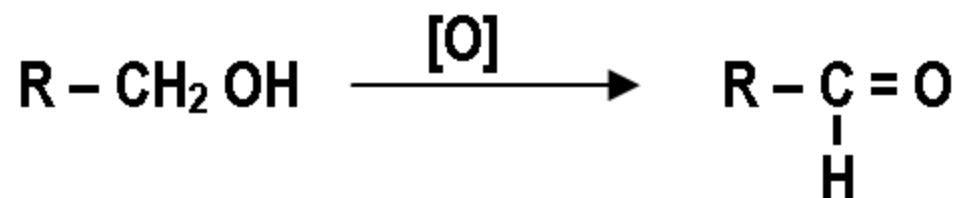
- IUPAC : 3 – bromobutanal
- TRIVIAL : β - bromobutiraladehid

□ SIFAT FISIKA ALDEHID / KETON :

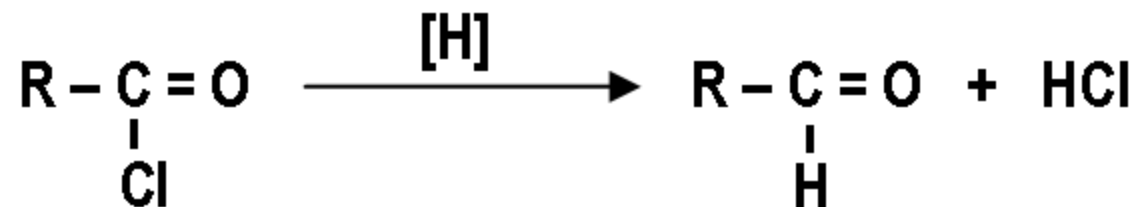
- Polar
- TD > TD Alkana
- BM < : larut dalam air
- BM > : larut dalam pelarut organik

■ Pembuatan Aldehid

1. Oksidasi alkohol primer

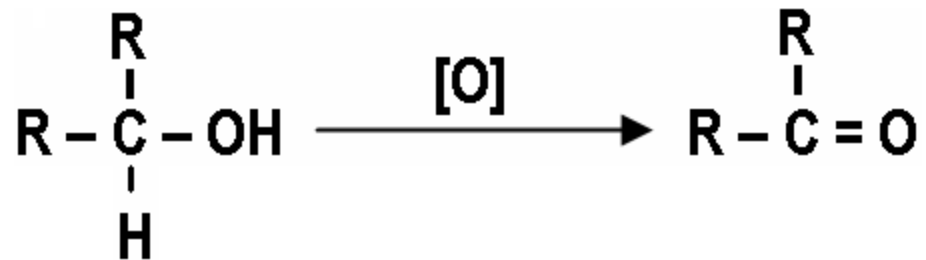


2. Reduksi asil klorida

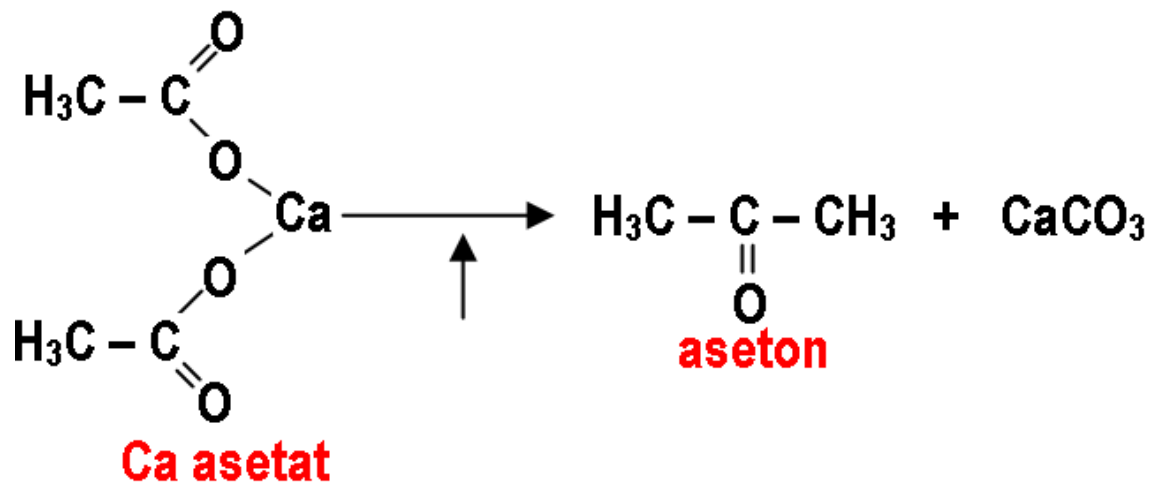


Pembuatan Keton

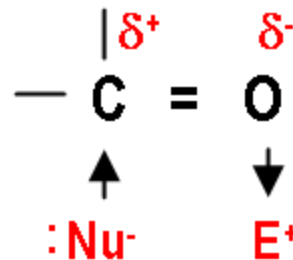
- ## 1. Oksidasi alkohol sekunder



- ## 2. Pirolisa garam karboksilat



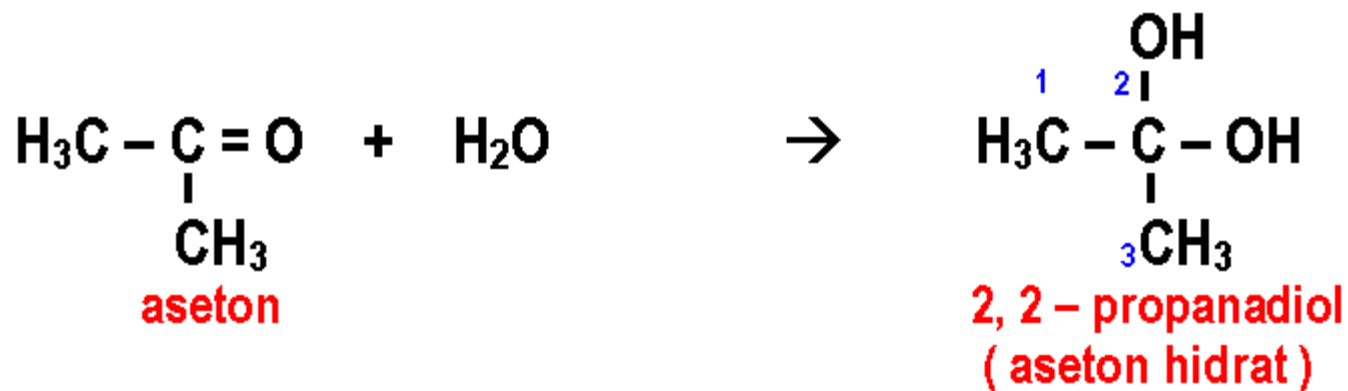
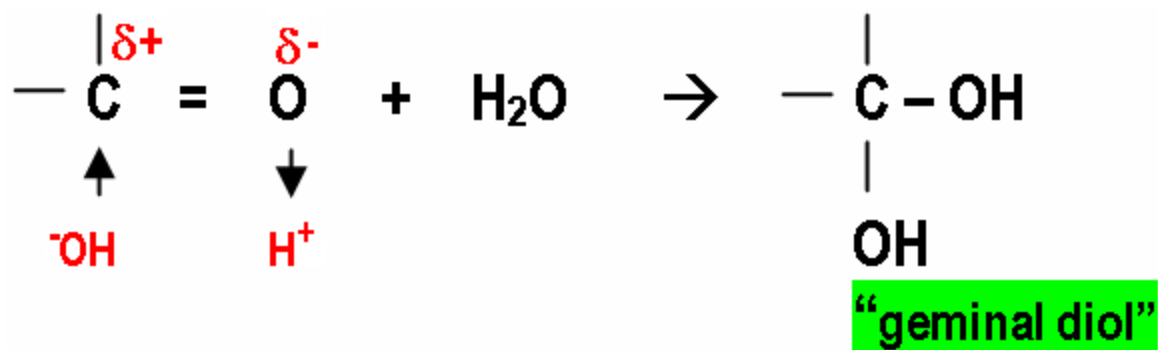
■ Sifat Gugus Karbonil



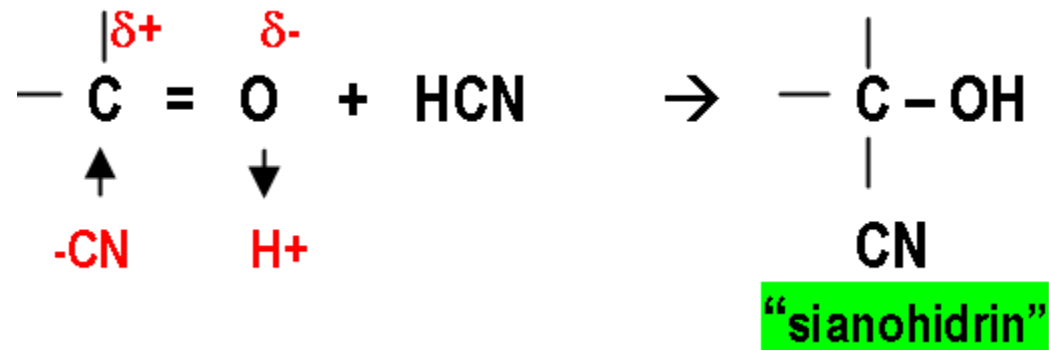
- Gugus -C=O bersifat polar $\rightarrow$
dapat menerima Nu^- atau E^+

REAKSI KIMIA :

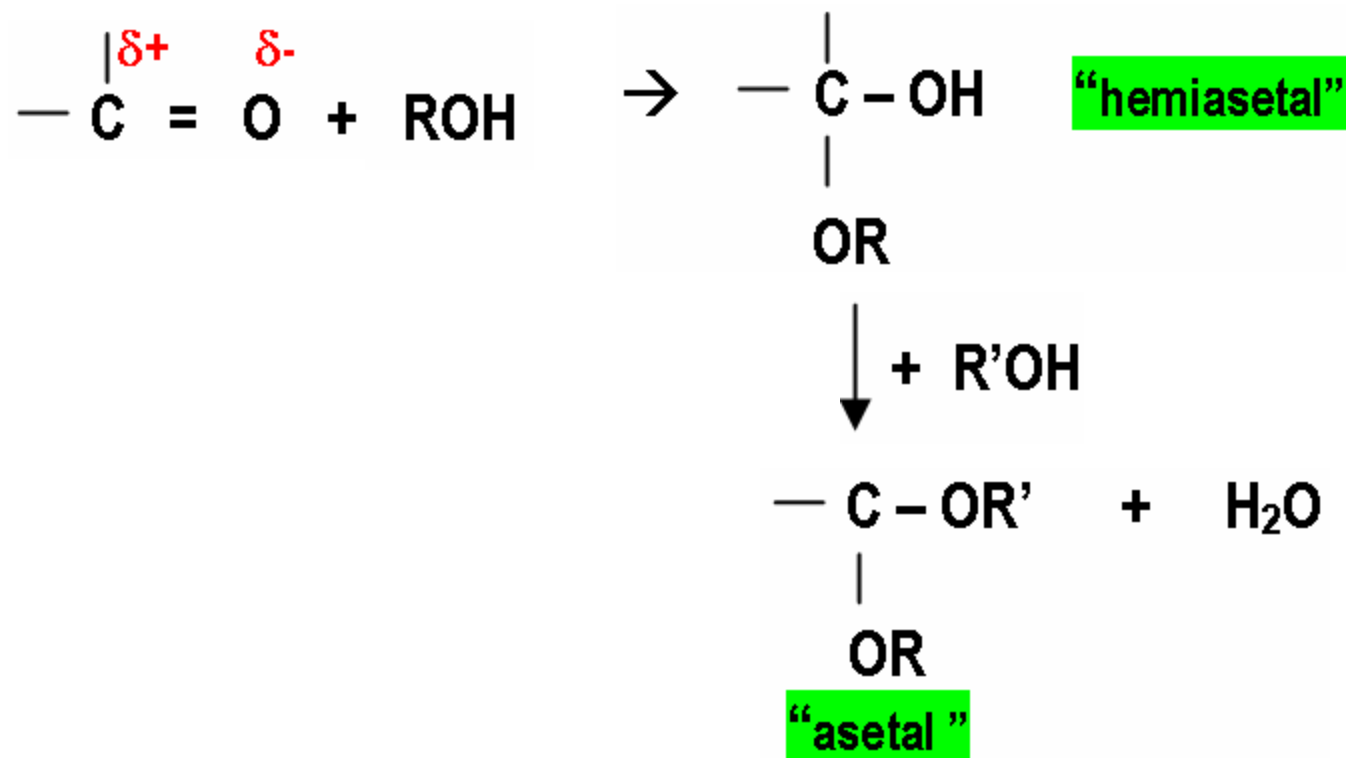
1. Adisi H₂O



2. Adisi nitril (sianida)

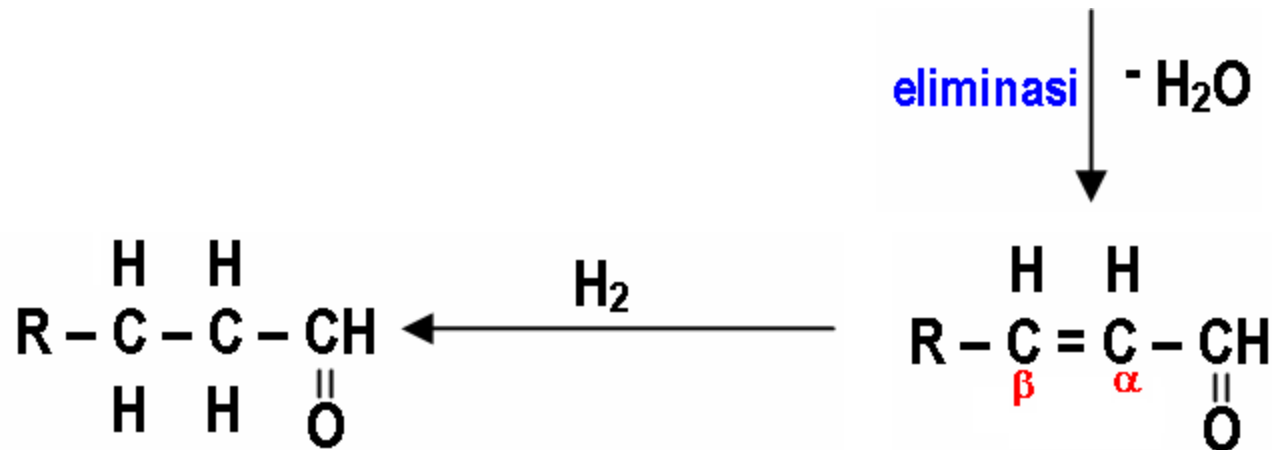
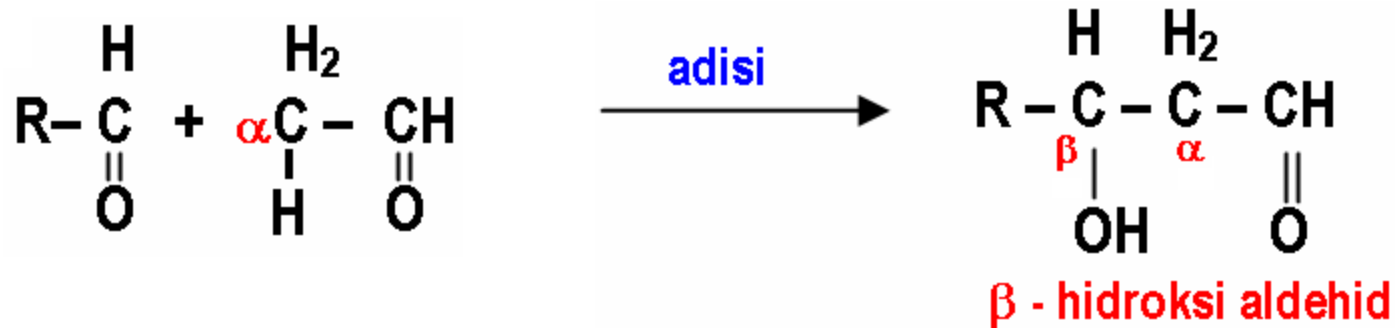


3. Adisi alkohol



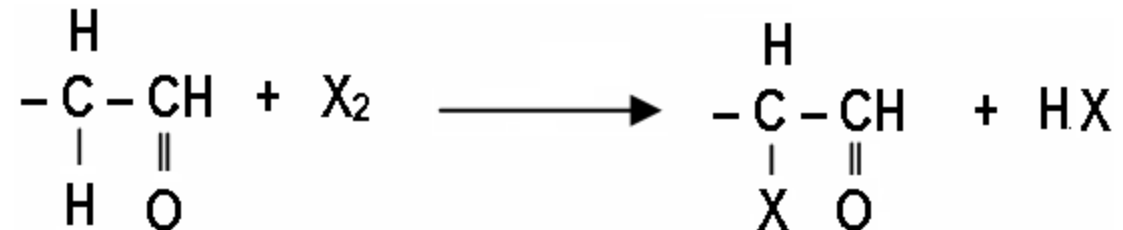
4. Kondensasi Aldol

- Adisi molekul aldehid yang mempunyai α -hidrogen ke molekul aldehid yang lain
(adisi diri / *self addition*)

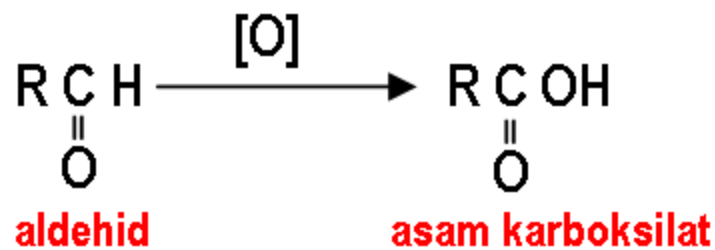


“aldehid α , β tidak jenuh”

5. α - Halogenasi



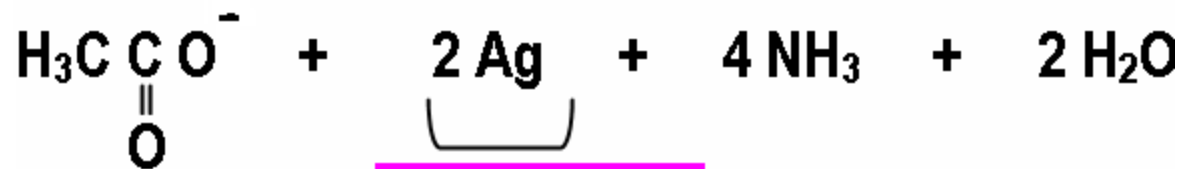
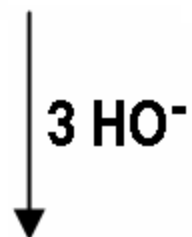
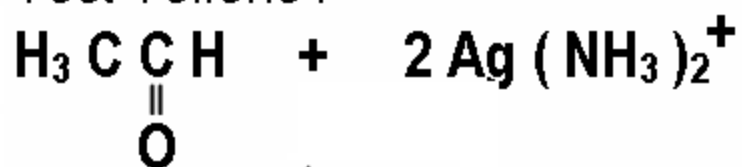
6. Reaksi Oksidasi



□ Oksidator :

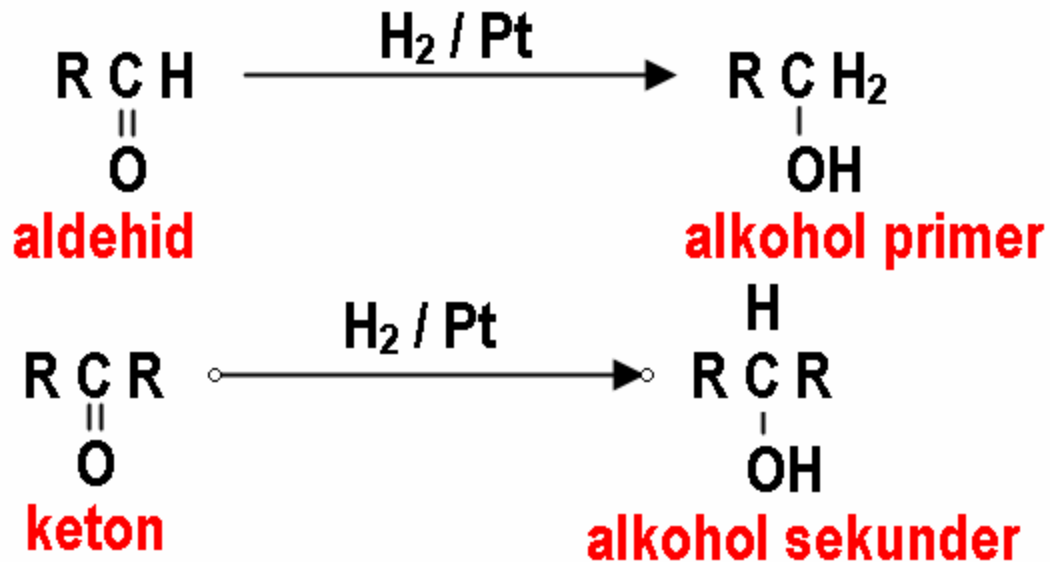
- KMnO_4
- $\text{K}_2 \text{Cr}_2 \text{O}_7$
- $\text{Ag} (\text{NH}_3)_2^+$ pereaksi Tollens

Test Tollens :



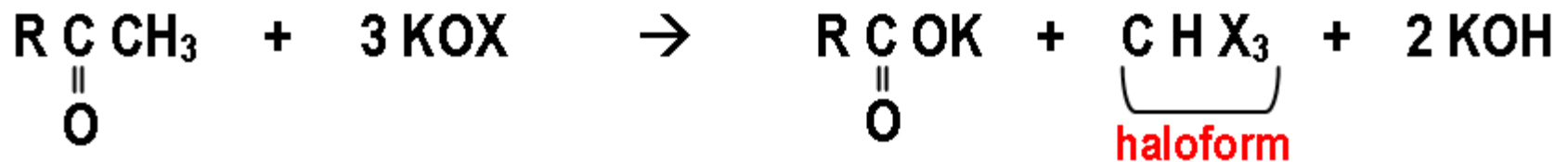
cermin perak

7. Reaksi reduksi

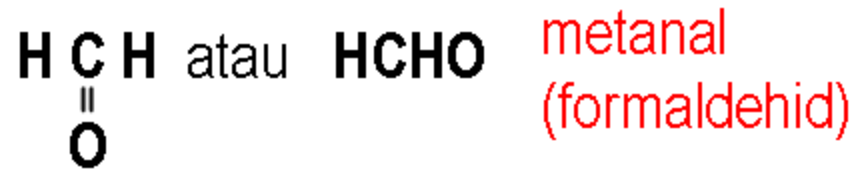


8. Reaksi pembentukan haloform

- Metil keton dioksidasi oleh KOX

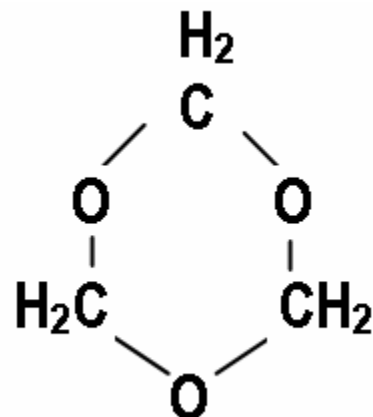


■ Cara penyimpanan metanal



Pada suhu kamar berbentuk gas → ada 3 cara penyimpanan :

1. Dilarutkan dalam air
 - Larutan formadehid dalam air disebut **formalin**
2. Dibuat trimer siklik



TRIOKSAN

3. Dibuat polimer

- $\text{CH}_2 \text{ O } \text{CH}_2 \text{ O } \text{CH}_2 \text{ O } \text{CH}_2 \text{ O } -$ **paraformaldehid** (berbentuk padat)

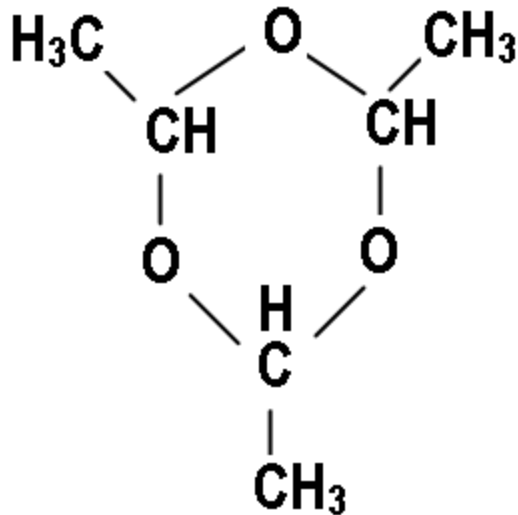
Formalin / Trioksan / Paraformaldehid, bila dipanaskan akan kembali menjadi formaldehid.

Cara penyimpanan etanal



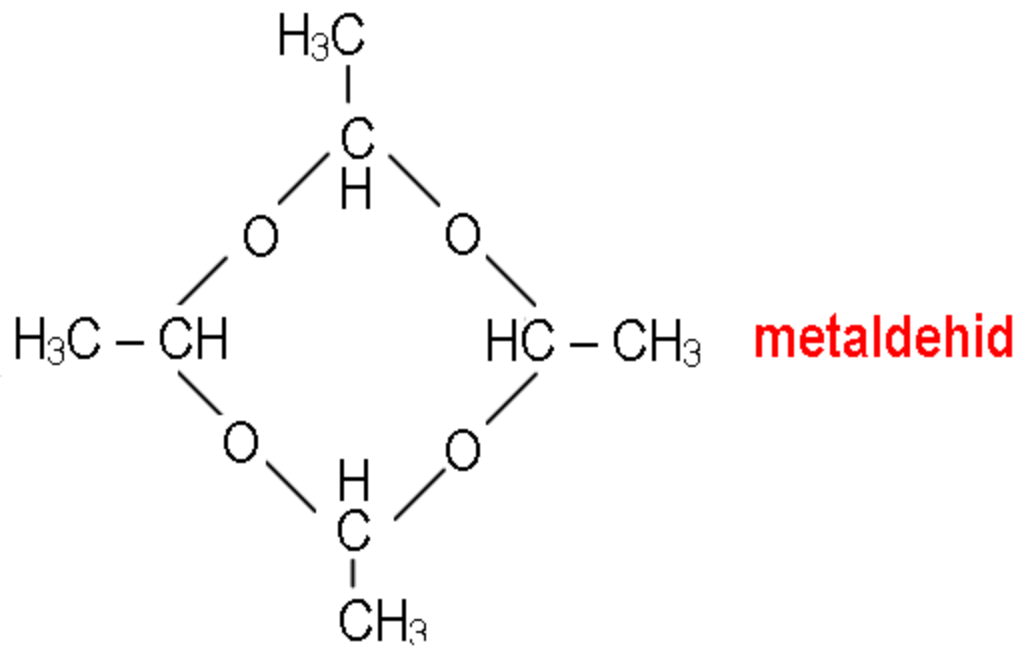
TD : 20°C → ada 2 cara penyimpanan :

1. Dibuat trimer siklik



paraldehid

2. Dibuat tetramer siklik



Paraldehid / Metaldehid bila dipanaskan akan kembali menjadi etanal

ASAM KARBOKSILAT



- C = O gugus karbonil

- OH gugus hidroksil





TATA NAMA:

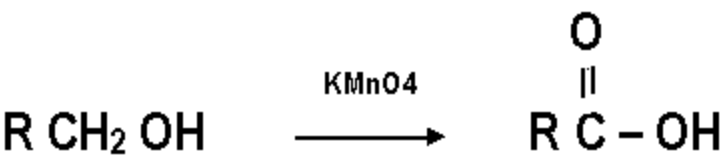
- IUPAC** Huruf akhir – a pada alkana diubah dengan imbuhan asam – oat
- TRIVIAL** Akhiran – aldehyd pada nama TRIVIAL aldehyd diubah dengan imbuhan asam - at

	IUPAC	TRIVIAL
HCOOH	asam metanoat	asam format
CH ₃ COOH	asam etanoat	asam asetat
CH ₃ CH ₂ COOH	asam propanoat	asam propionat
$ \begin{array}{c} \text{3} \quad \text{2} \quad \text{Br} \quad \text{1} \\ \text{CH}_3 \text{---} \text{CH} \text{---} \text{COOH} \\ \beta \quad \alpha \end{array} $	asam 2-bromopropanoat	asam α - bromopropionat
H ₂ C = CH CH ₂ COOH	asam 3 – butenoat	asam vinil asetat



Pembuatan :

1.Oksidasi alkohol primer



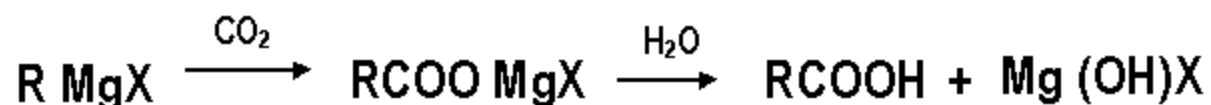
isobutil alkohol

asam isobutirat

2. Oksidasi aldehid

(lihat reaksi kimia aldehid)

3. Karbonasi pereaksi Grignard



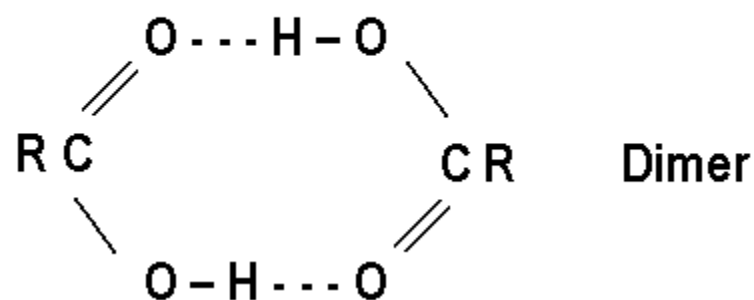
4. Hidrolisis senyawa nitril



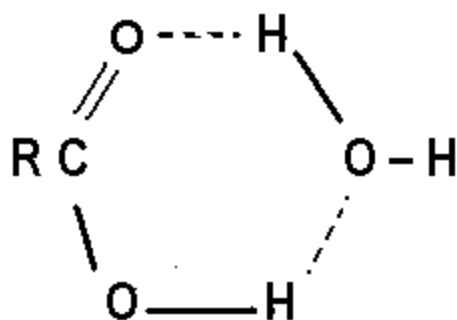
Sifat Fisika – Kimia

- Bersifat polar
- C1 s/d C4 larut dalam air
- BM > berbentuk padat
- TD Asam Karboksilat > TD Alkohol
- Keasaman :
Asam mineral > Asam Karboksilat > Alkohol

- Dapat membentuk 2 ikatan hidrogen antara sepasang molekul → menjadi dimer asam karboksilat



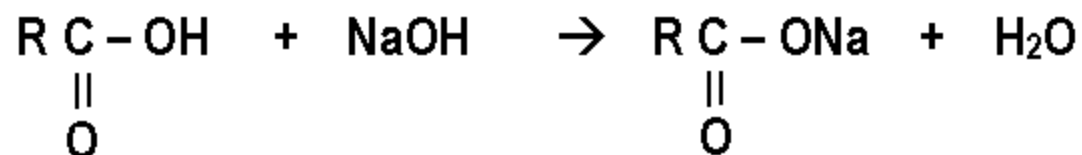
- Dapat membentuk ikatan hidrogen dengan H_2O



(..... ikatan hidrogen)

Reaksi Kimia

1. Dengan basa membentuk garam



2. Reduksi



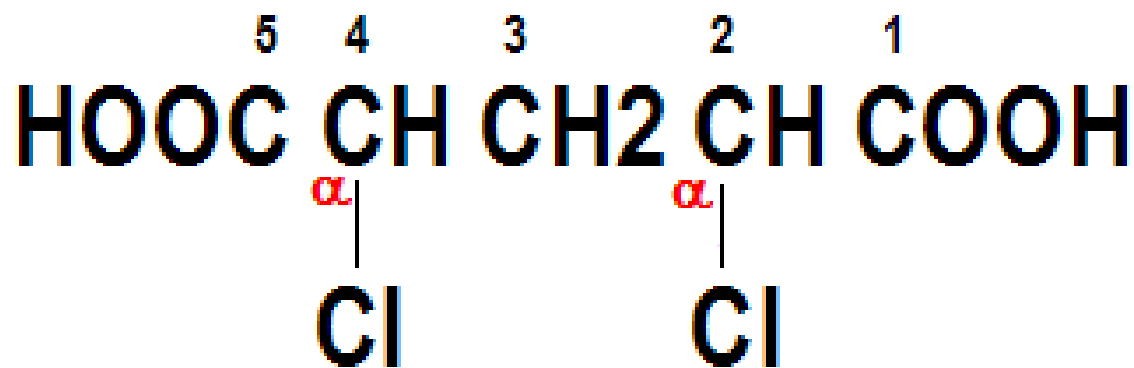
ASAM DIKARBOKSILAT

Senyawa dengan 2 gugus karboksil

Tata Nama :

Nama alkana diberi imbuhan asam – dioat

	IUPAC	TRIVIAL
$\text{HOOC} - \text{COOH}$	asam etanadioat	asam oksalat
$\text{HOOC CH}_2 \text{COOH}$	asam propanadioat	asam malonat
$\text{HOOC CH}_2 \text{CH}_2 \text{COOH}$	asam butanadioat	asam suksinat
$\text{HOOC CH}_2 \text{CH}_2 \text{CH}_2 \text{COOH}$	asam pentanadioat	asam glutarat

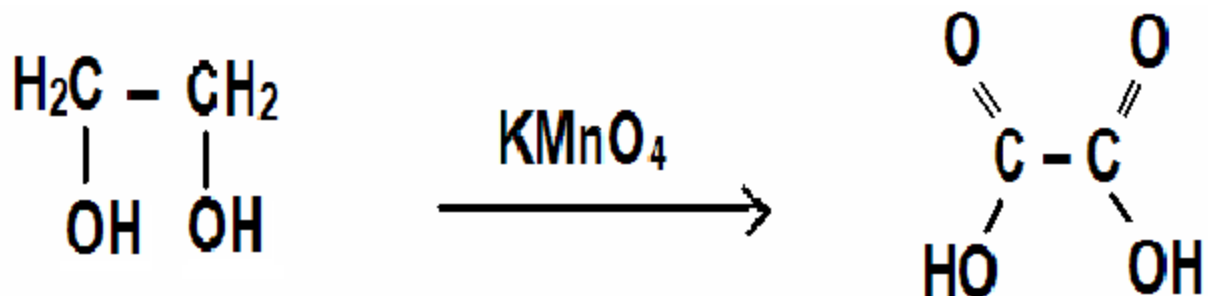


IUPAC : Asam 2, 4 – dikloro pentanadioat

TRIVIAL : Asam α, α' – dikloro glutarat

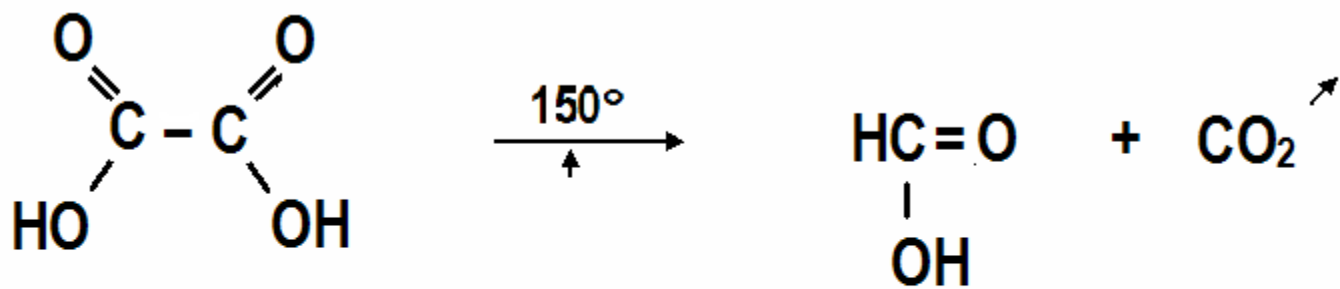
Pembuatan :

Oksidasi senyawa diol



Reaksi Kimia :

Dekarboksilasi

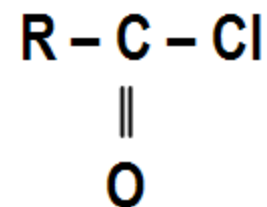


asam etanadioat
(asam oksalat)

asam metanoat
(asam format)

TURUNAN ASAM KARBOKSILAT

I. ASILKLORIDA (KLORIDA ASAM)

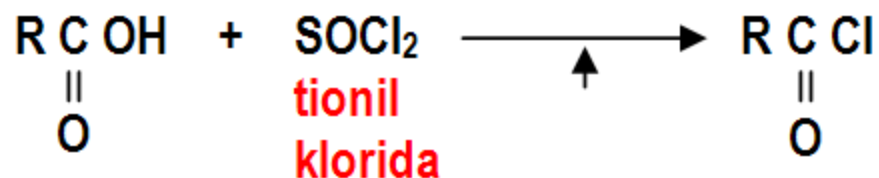


Tata Nama :

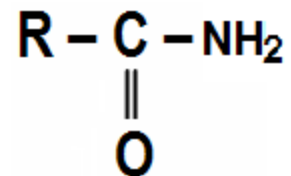
Asam – at pada asam karboksilat diubah menjadi – il klorida

	IUPAC	TRIVIAL
$\begin{array}{c} \text{H} - \text{C} - \text{Cl} \\ \parallel \\ \text{O} \end{array}$	metanoil klorida	formil klorida
$\begin{array}{c} \text{H}_3\text{C} - \text{C} - \text{Cl} \\ \parallel \\ \text{O} \end{array}$	etanoil klorida	asetil klorida

Pembuatan :



II. A M I D A

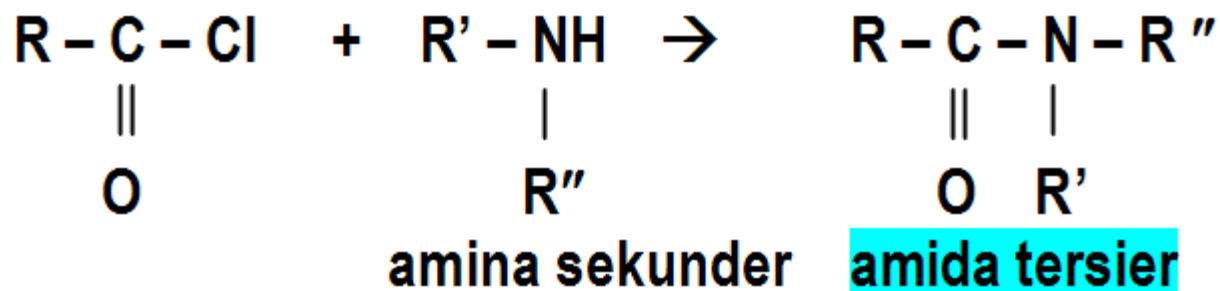
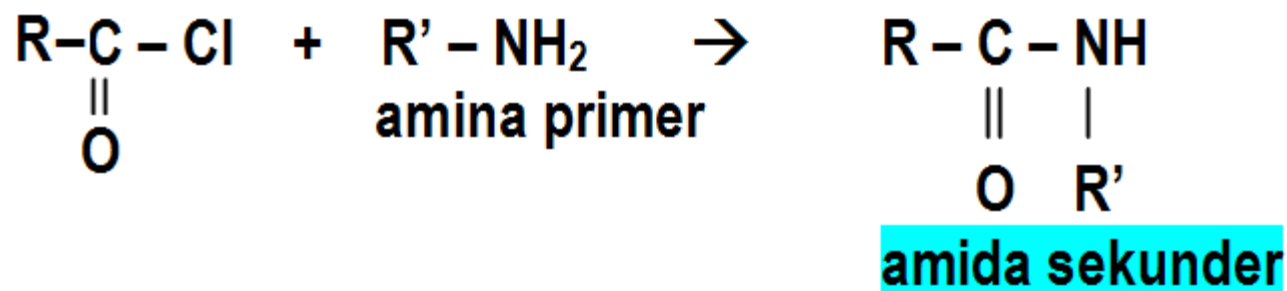
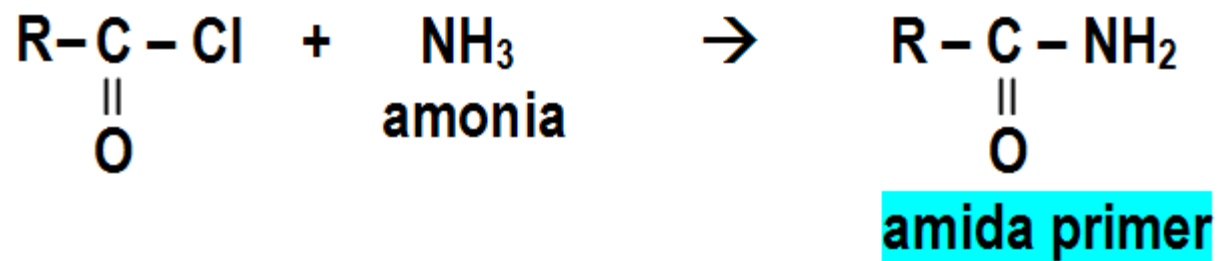


Tata Nama :

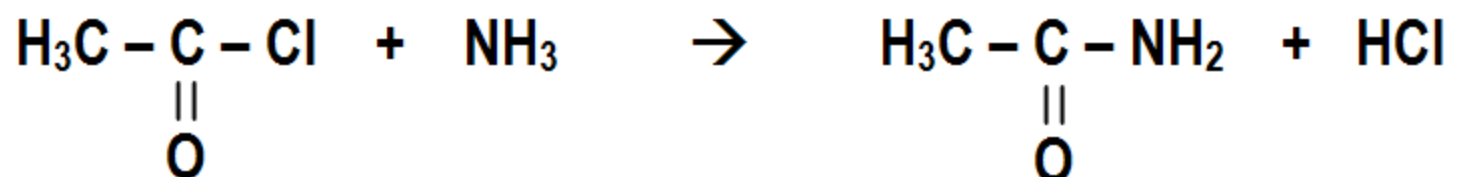
Asam – at pada asam karboksilat diubah menjadi amida

	IUPAC	TRIVIAL
$\begin{array}{c} \text{H} \text{ C} \text{ NH}_2 \\ \parallel \\ \text{O} \end{array}$	Metanamida	formamida
$\begin{array}{c} \text{H}_3\text{C} \text{ C} \text{ NH}_2 \\ \parallel \\ \text{O} \end{array}$	Etanamida	asetamida

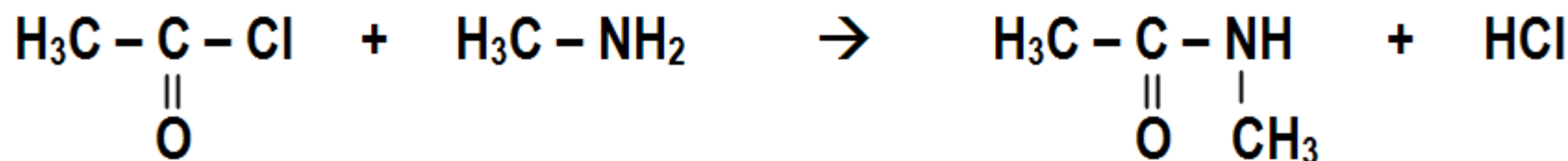
Pembuatan:



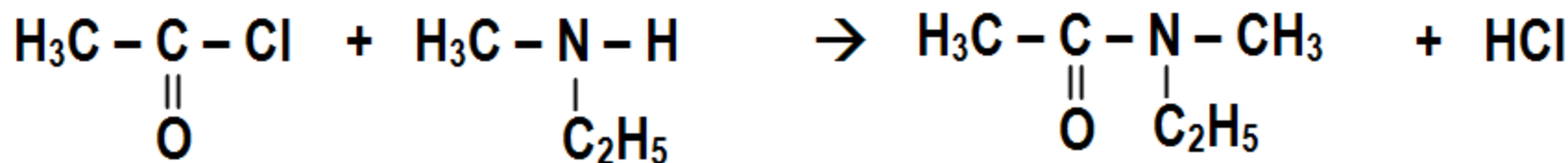
Contoh:



etanamida (asetamida)



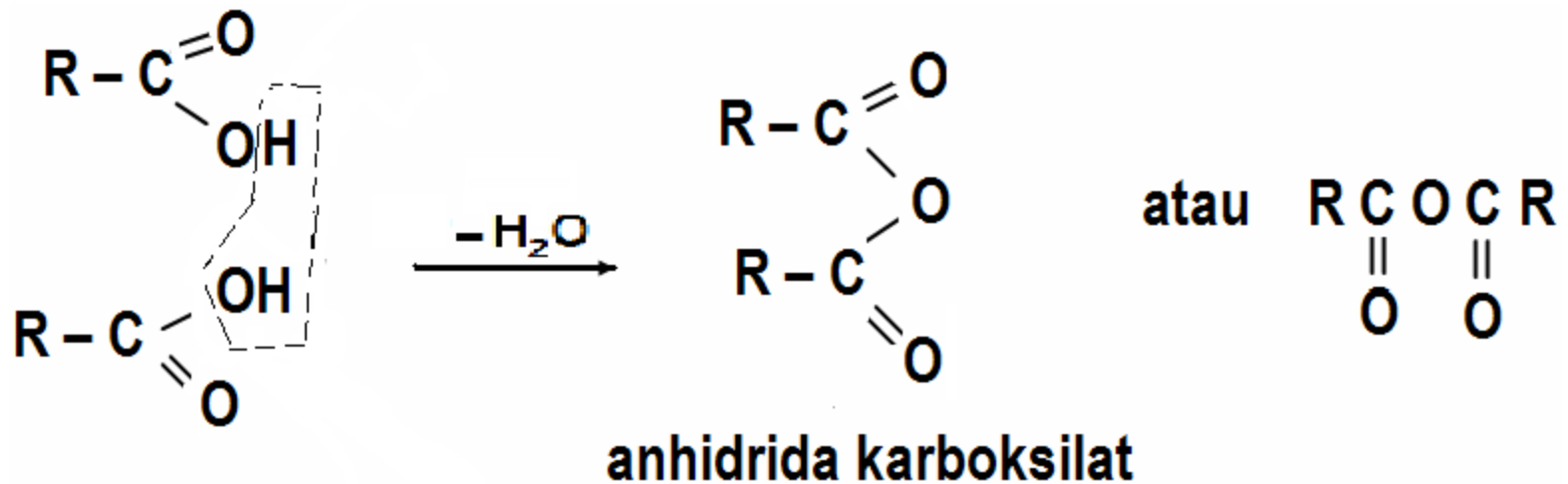
N-metil etanamida



N-metil-N-etil etanamida

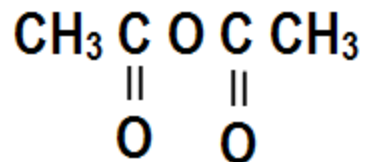
III. ANHIDRIDA KARBOKSILAT

Dua molekul asam karboksilat melepaskan 1 molekul H_2O



Tata Nama :

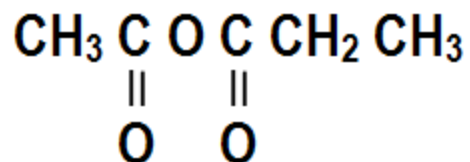
1. Anhidrida Simetris (dua gugus asil sama)



IUPAC : anhidrida etanoat

TRIVIAL : anhidrida asetat

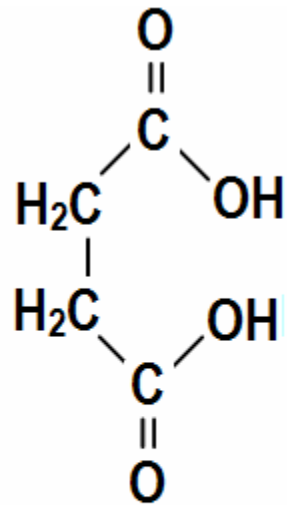
2. Anhidrida Asimetris (2 gugus asil tidak sama)



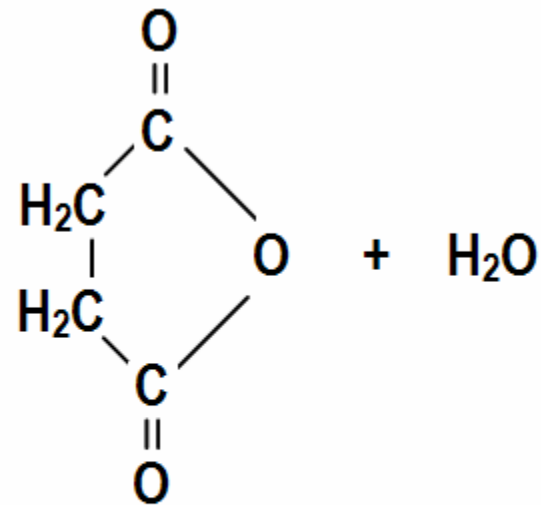
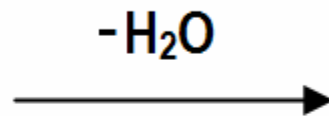
IUPAC : anhidrida etanoat propanoat

TRIVIAL : anhidrida asetat propionat

Pembuatan :

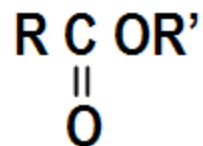


asam butanadioat
(asam suksinat)



anhidrida suksinat
anhidrida siklik

IV. E S T E R

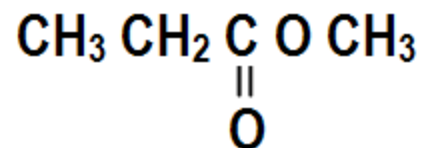


atau RCOOR'

dimana : R = gugus alkil

Tata Nama :

Ester diberi nama alkil karboksilat

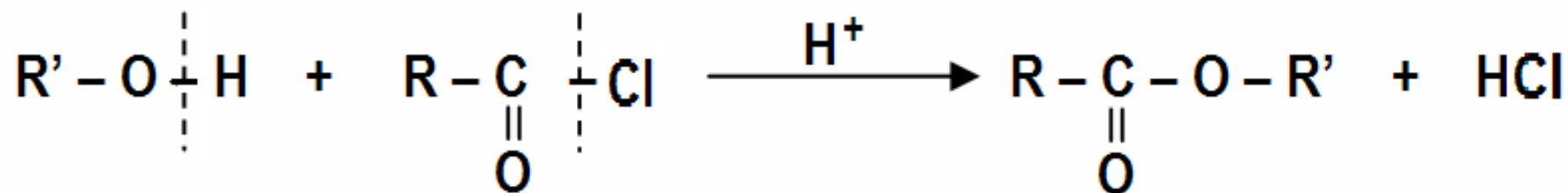
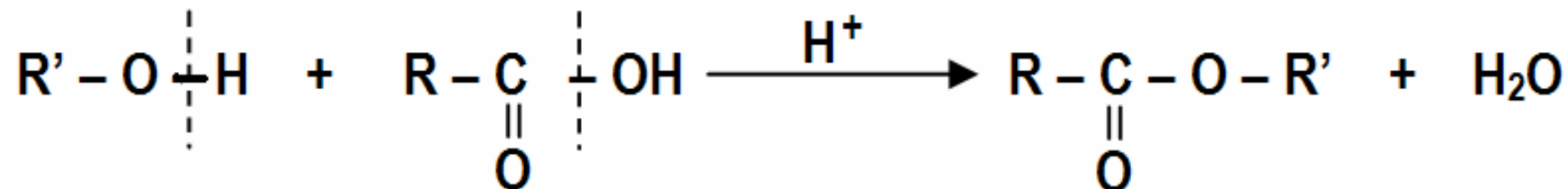


IUPAC : metil propanoat

TRIVIAL : metil propionat

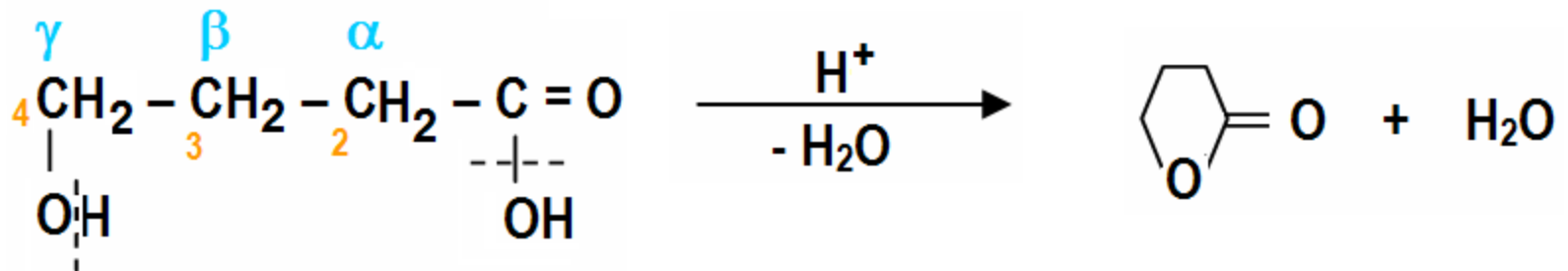
PEMBUATAN ESTER (Esterifikasi)

Reaksi alkohol dengan asam karboksilat atau turunan asam karboksilat
(Esterifikasi Fischer)



Ester Siklik (Lakton)

Dibentuk dari molekul yang mempunyai 1 gugus karboksil dan 1 gugus hidroksil



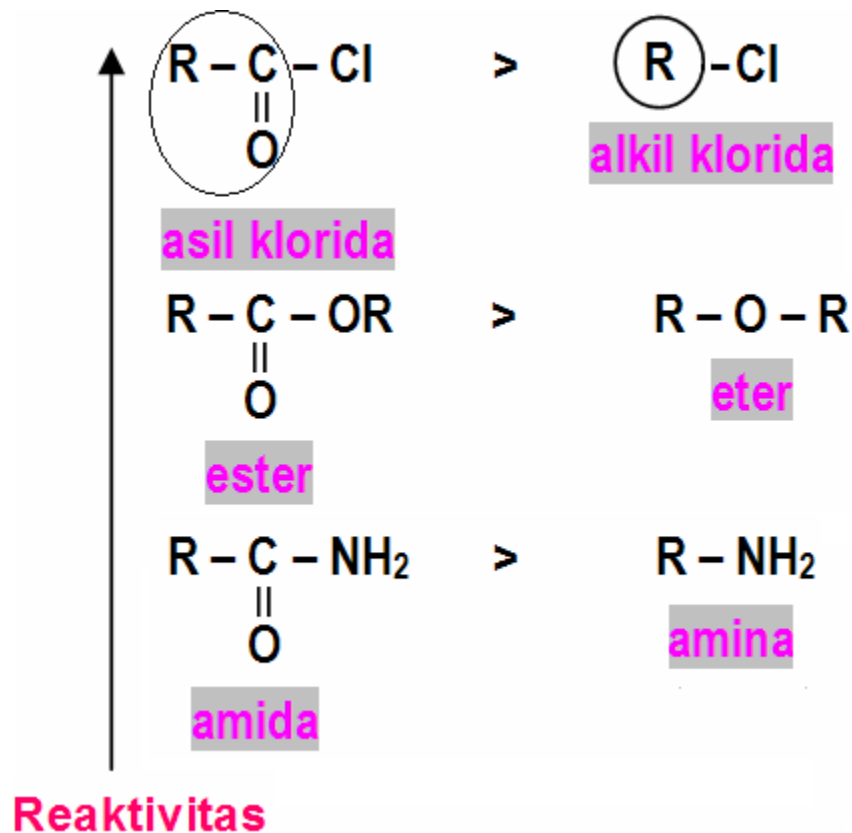
asam 4-hidroksi butanoat
(asam γ - hidroksi butirrat)

4 – butanolakton
(γ - butirolakton)

SIFAT KIMIA :

1. Asam karboksilat dan turunannya mempunyai gugus asil : $\text{R} \begin{array}{c} \text{C} - \\ || \\ \text{O} \end{array}$ -
- dapat mengalami substitusi nukleofil.

Reaktivitas substitusi nukleofil senyawa dengan gugus asil > senyawa dengan gugus alkil.



- Pada sintesis senyawa organik, asam karboksilat yang kurang reaktif diubah dulu menjadi senyawa yang paling reaktif yaitu asilklorida

2. Semua turunan asam karboksilat bila dihidrolisis akan menjadi asam karboksilat.

