

Corso di Laurea Magistrale in Ingegneria dell'Innovazione del Prodotto
a.a. 2022-23
Anno I – Semestre I



Tecnologia dei materiali polimerici

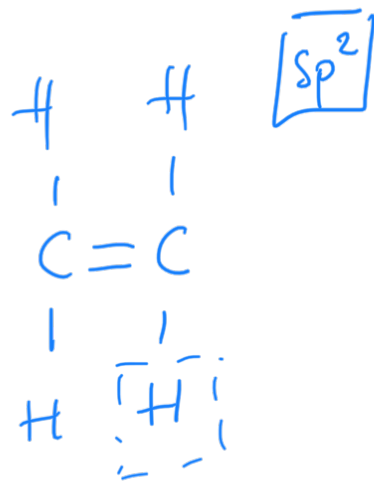
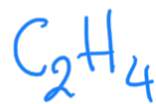
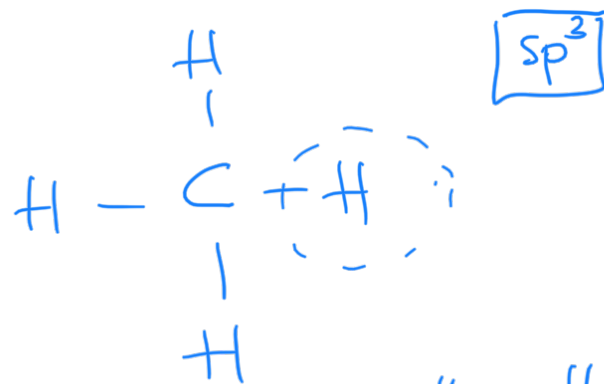
Lezione 4

Prof. Lisa Biassetto

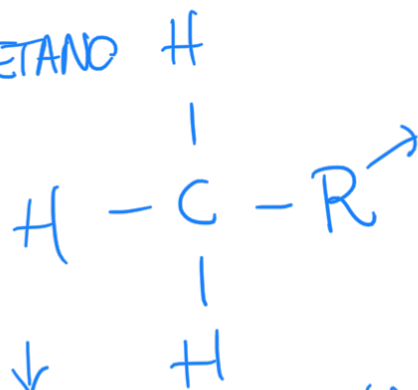
E-mail: lisa.biassetto@unipd.it

IDROCARBUR (ALIFATICI)

- ALCANI (C_nH_{2n+2}) \rightarrow CH_4
- ALCENI (C_nH_{2n})
- ALCHINI (C_nH_{2n-2})

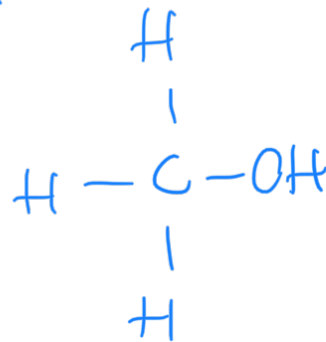


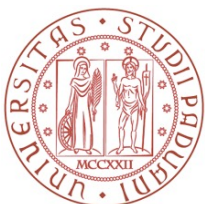
METANO



\rightarrow gruppo funzionale

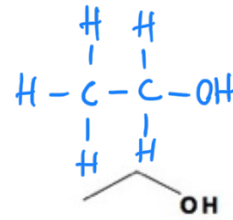
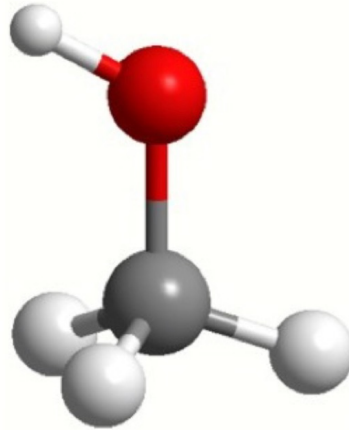
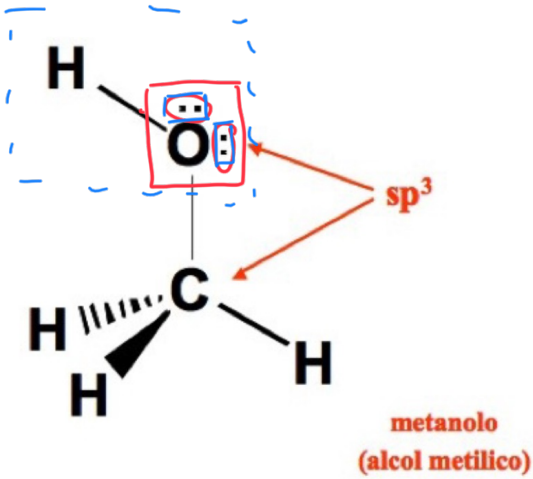
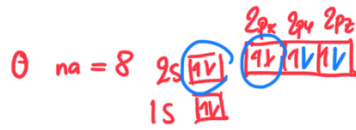
METANOL



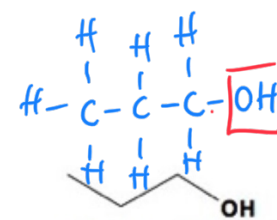


- ❖ Gli alcoli
 - ❖ Le ammine
 - ❖ Acidi ed esteri
 - ❖ Gli epossidi
 - ❖ Alcune tipologie di polimeri e loro formulazioni
 - ❖ Reazioni di polimerizzazione
- } → GRUPPI FUNZIONALI
specie chimiche che sostituiscono
il 'H' negli idrocarburi

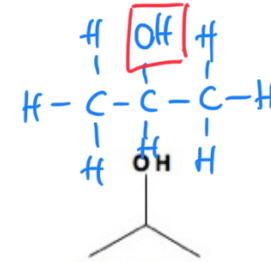
ALCOLI



Etanolo
(alcol etilico)



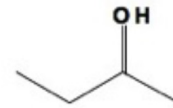
1-propanolo
(alcol propilico)



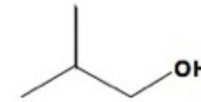
2-propanolo
(alcol isopropilico)



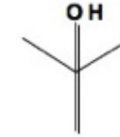
1-butanolo
(alcol butilico)



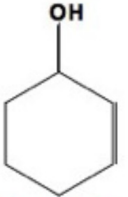
2-butanolo
(alcol *sec*-butilico)



2-metil-1-propanolo
(alcol isobutilico)



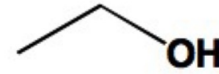
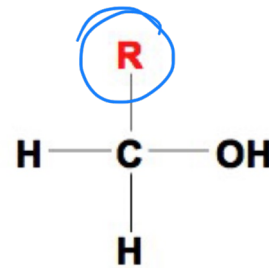
2-metil-2-propanolo
(alcol *terz*-butilico)



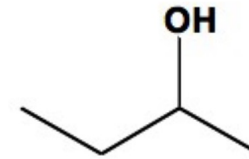
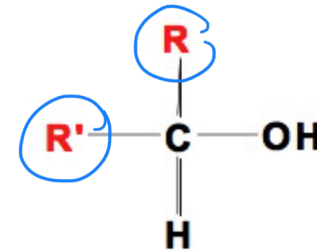
cicloesano
(alcol cicloesilico)

SOLUBILI in ACQUA

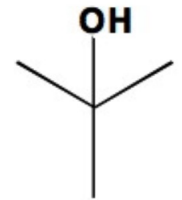
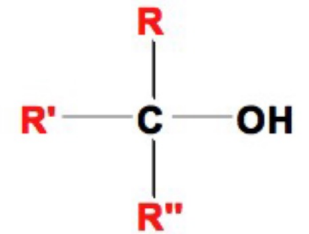
ALCOLI



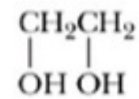
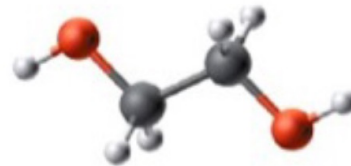
alcol primario



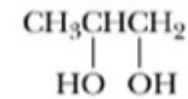
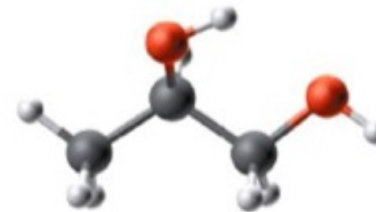
alcol secondario



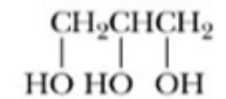
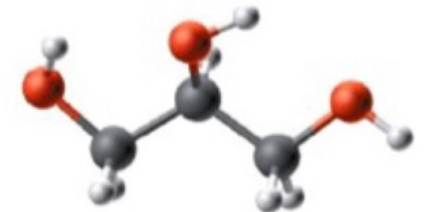
alcol terziario



1,2-Etandiolo
(Glicole etilenico)

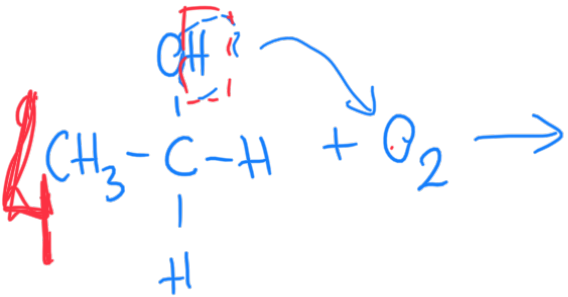


1,2-Propandiolo
(Glicole propilenico)

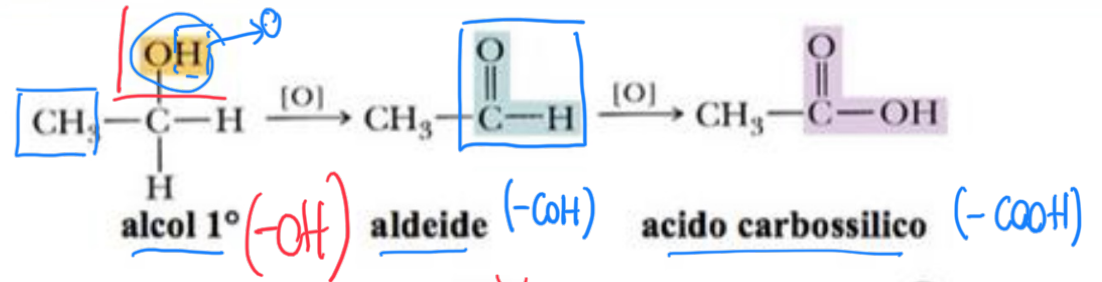


1,2,3-Propantriolo
(Glicerolo, Glicerina)

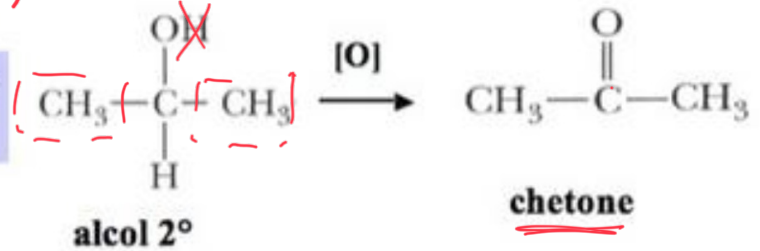
ALCOLI



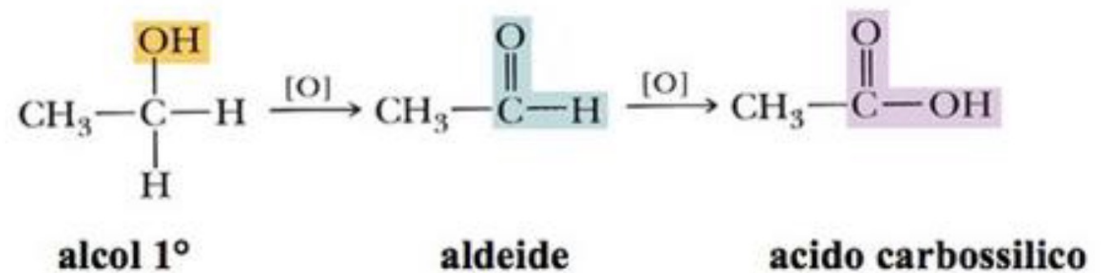
Un alcol 1° si ossida ad aldeide e successivamente ad acido carbossilico



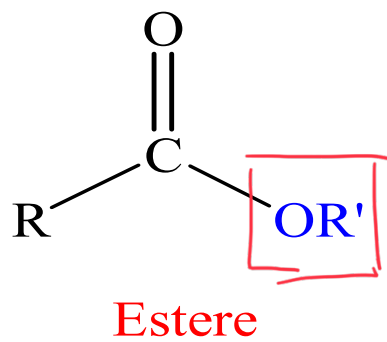
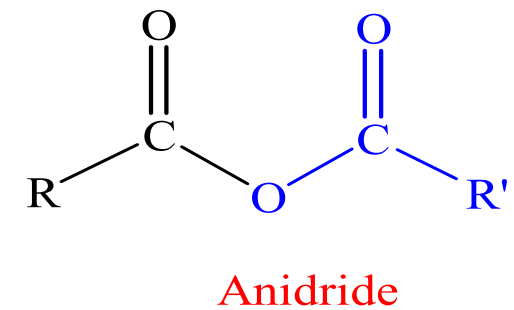
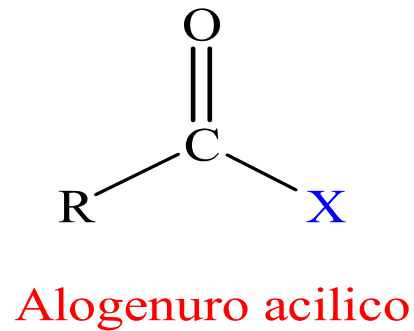
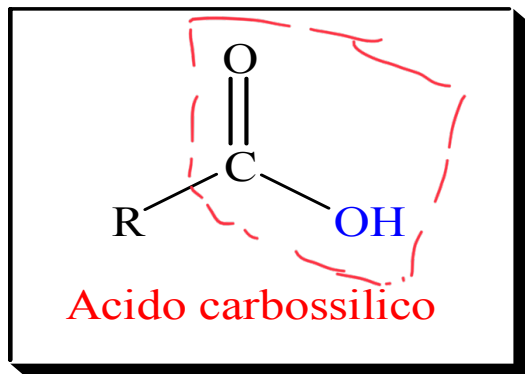
Un alcol 2° si ossida a chetone



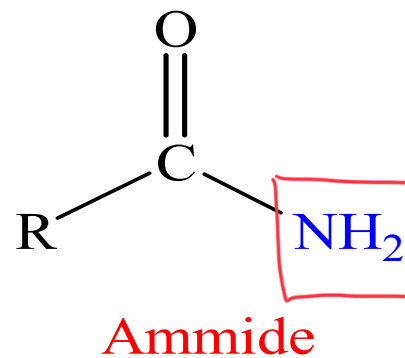
Un alcol 3° non si ossida facilmente



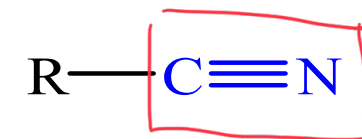
ACIDI CARBOSSILICI E DERIVATI



↓
POLIESTERE [PET]

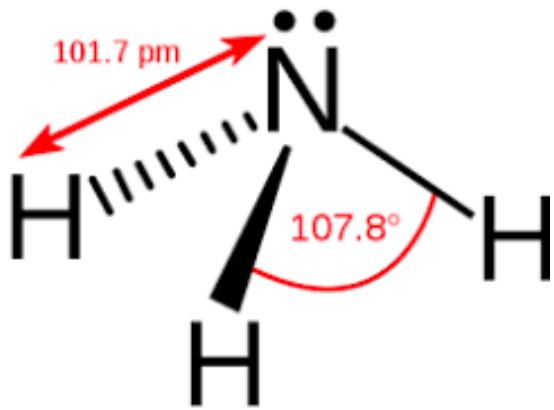


↓
POLIAMMIDI



↓
Nylon 6,6
Nylon 6,12

AMMINE



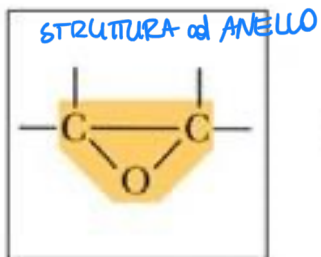
Ammine Primarie

Ammine Secondarie

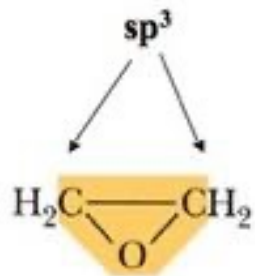
Ammine Terziarie

EPOSSIDI

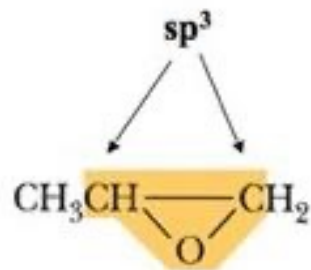
Resina Epossidica



gruppo funzionale di un epossido

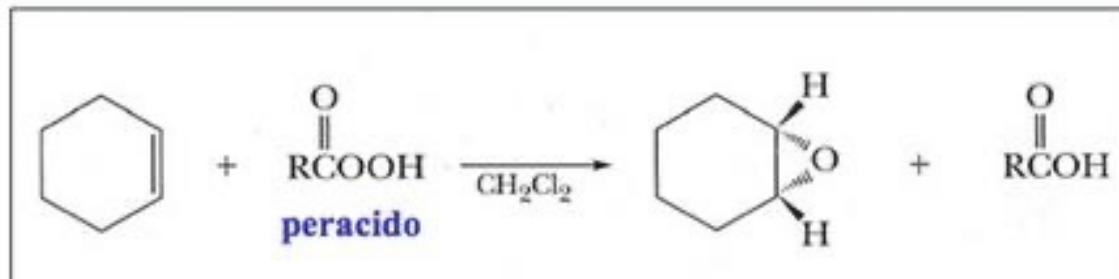


ossido di etilene



ossido di propilene

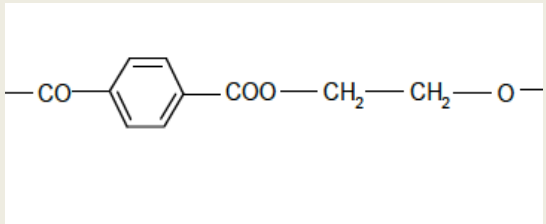
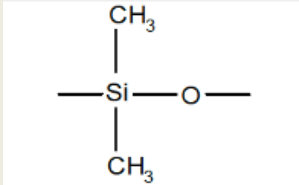
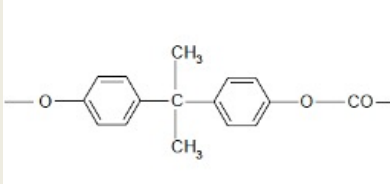
Si ottengono dagli alcheni per ossidazione con peracidi:

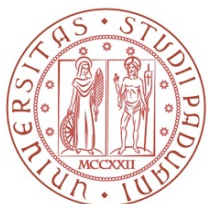


POLIMERO	SIGLA	MONOMERO/ REAGENTI	UNITA' DI RIPETIZIONE
POLIETILENE	PE	Etilene $\text{CH}_2=\text{CH}_2$	$-\text{CH}_2-\text{CH}_2-$
POLIMERI VINILICI			
POLIPROPILENE	PP	Propilene $\text{CH}_2=\text{CH}-\text{CH}_3$	$ \begin{array}{c} -\text{CH}_2-\text{CH}- \\ \\ \text{CH}_3 \end{array} $
POLISTIRENE	PS	Stirene $\text{CH}_2=\text{CH}-\text{C}_6\text{H}_5$	$ \begin{array}{c} -\text{CH}_2-\text{CH}- \\ \\ \text{C}_6\text{H}_5 \end{array} $
ACETATO DI VINILE	PVAc	Acetato di vinile $\text{CH}_2=\text{CH}-\text{OCO}-\text{CH}_3$	$ \begin{array}{c} -\text{CH}_2-\text{CH}- \\ \\ \text{OCOCH}_3 \end{array} $

POLIMERO	SIGLA	MONOMERO/ REAGENTI	UNITA' DI RIPETIZIONE
POLIMERI ACRILICI			
POLIMETILMETACRILATO	PMMA	Metacrilato di Metile $\text{CH}_2=\text{C}(\text{CH}_3) - \text{COOCH}_3$	$ \begin{array}{c} \text{CH}_3 \\ \\ - \text{CH}_2 - \text{C} - \\ \\ \text{COOCH}_3 \end{array} $
POLIACRILONITRILE	PAN	Nitrile dell'acido acrilico $\text{CH}_2=\text{CH}-\text{CN}$	$ \begin{array}{c} - \text{CH}_2 - \text{CH} - \\ \\ \text{CN} \end{array} $

POLIMERO	SIGLA	MONOMERO/ REAGENTI	UNITA' DI RIPETIZIONE
POLIMERI DIENICI			
POLIBUTADIENE 1,4	PB	Butadiene $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$	$-\text{CH}_2-\text{CH}_2-$
POLIISOPRENE 1,4	PI	Isoprene $\text{CH}_2=\text{CH}-\text{C}(\text{CH}_3)=\text{CH}_2$	$\text{CH}_2-\text{CH}-\text{C}(\text{CH}_3)-\text{CH}_2$
POLIAMMIDI			
POLIAMMIDE 6	PA6	ϵ -caprolattame <ul style="list-style-type: none"> ◦ $\text{H}_2\text{N}(\text{CH}_2)_5\text{COOH}$ • $\text{HN}(\text{CH}_2)_5\text{CO}$ 	$-\text{HN}(\text{CH}_2)_5\text{CO}-$
POLIAMMIDE 6,6	PA66	Acido Adipico +esametildiammina $\text{HOCO}(\text{CH}_2)_4\text{COOH} + \text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2$	$-\text{HN}(\text{CH}_2)_6\text{NHCO}(\text{CH}_2)_4\text{CON}-$

POLIMERO	SIGLA	MONOMERO/ REAGENTI	UNITA' DI RIPETIZIONE
POLIESTERI			
POLIETILENTEREFTALATO	PET	Acido tereftalico + glicole etilenico $\text{HOOC-C}_6\text{H}_5\text{-COOH}$ + $\text{HOCH}_2\text{-CH}_2\text{OH}$	
ALTRI			
POLIDIMETILSILOSSANO	PDMS	dimetilsilandiolo $\text{HO-Si(CH}_3)_2\text{-OH}$	
POLICARBONATO	PC	Acido Adipico +esametildiammina $\text{HOCO(CH}_2)_4\text{COOH} + \text{H}_2\text{N(CH}_2)_6\text{NH}_2$	



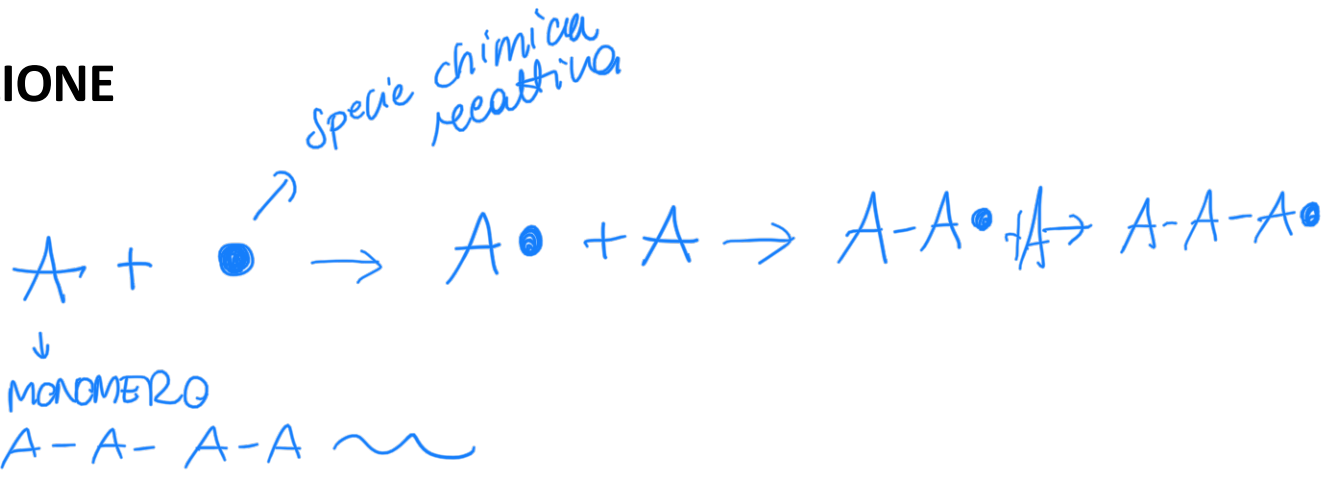
Corso di Laurea Magistrale in Ingegneria dell'Innovazione del Prodotto
a.a. 2022-23
Anno I – Semestre I



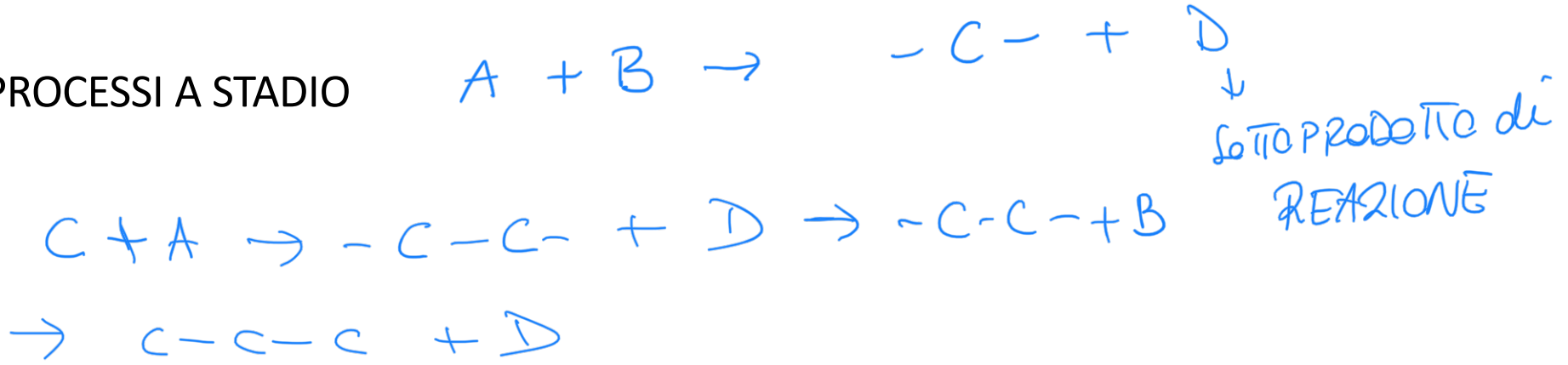
- ❖ Reazioni di polimerizzazione
- ❖ Reazioni di poliaddizione
- ❖ Poliaddizioni radicaliche

REAZIONI DI POLIMERIZZAZIONE

① POLIADDIZIONI



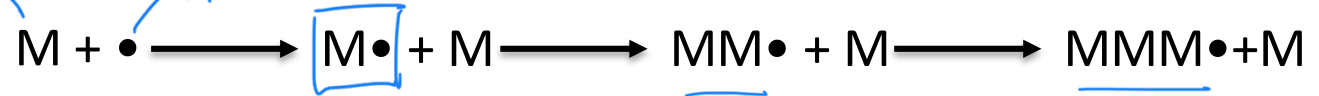
② PROCESSI A STADIO



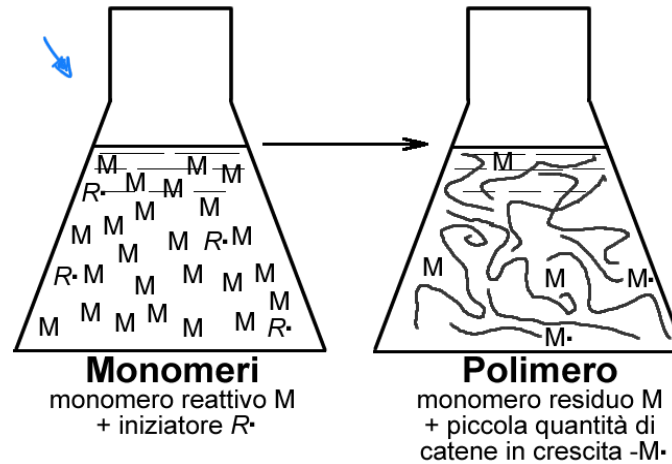
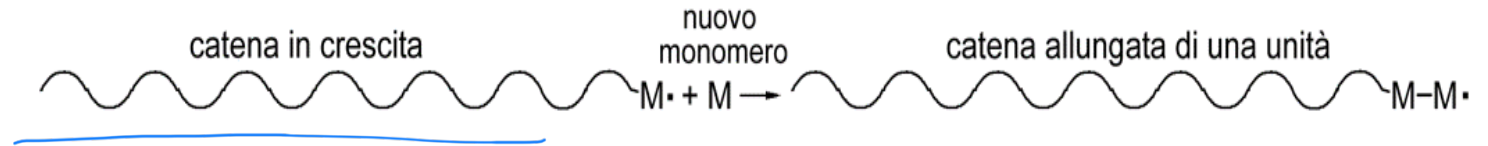
REAZIONI A CATENA

Monomero
POLIADDIZIONE
specie reattiva

1) INIZIO



2) PROPAGAZIONE



3) TERMINAZIONE

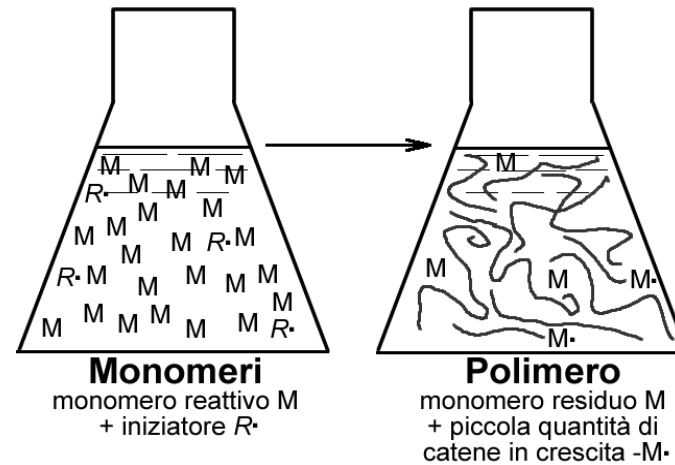
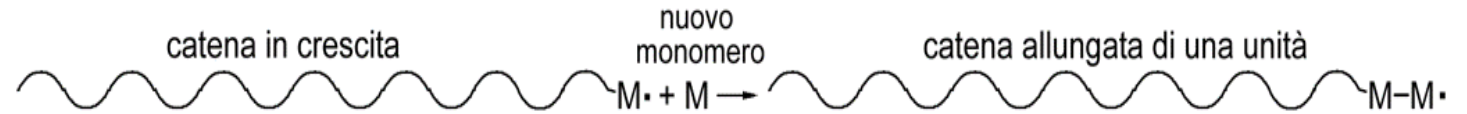


REAZIONI A CATENA

1) INIZIO



2) PROPAGAZIONE



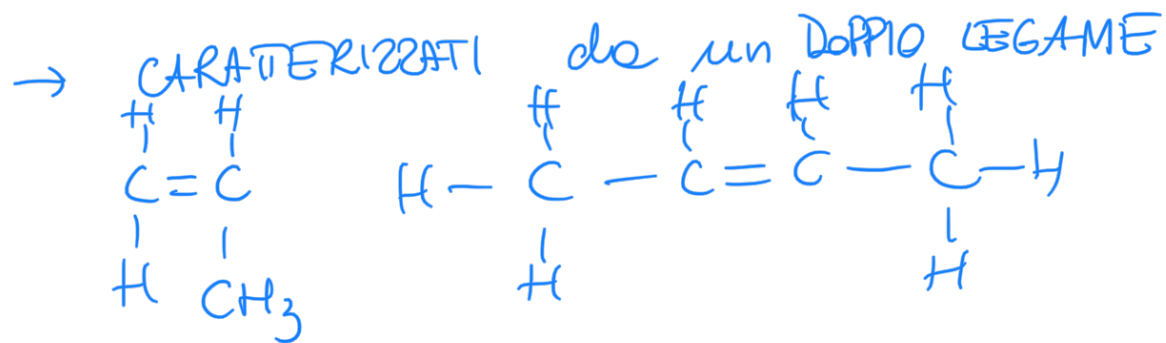
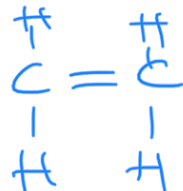
3) TERMINAZIONE



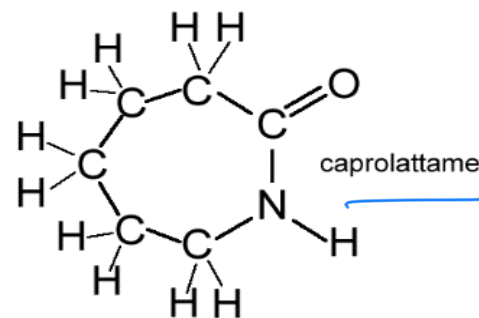
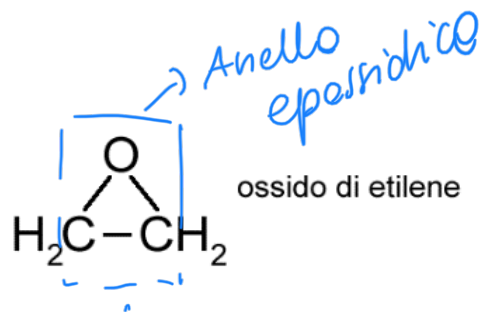
REAZIONI A CATENA

MONOMERI

➤ MONOMERI INSATURI

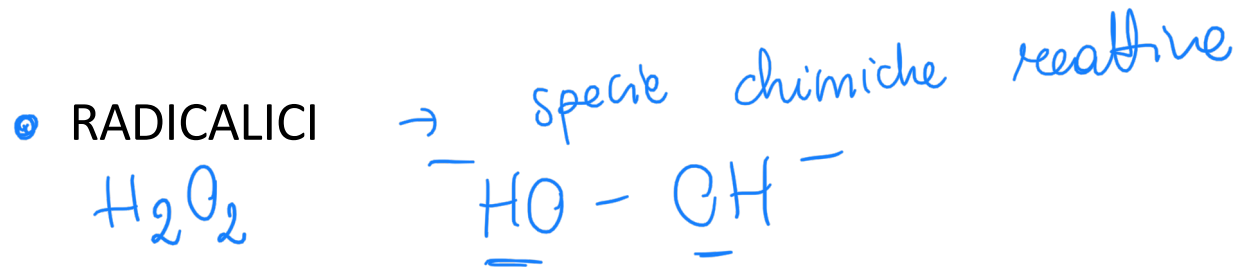


➤ STRUTTURA AD ANELLO



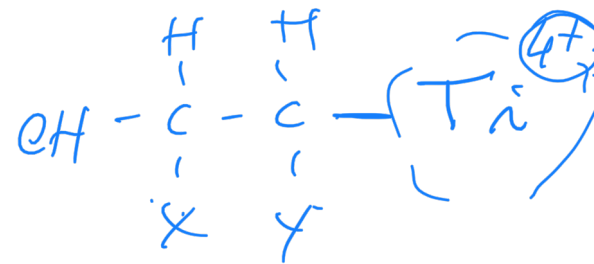
REAZIONI A CATENA

INIZIATORI



• STEREOSPECIFICI

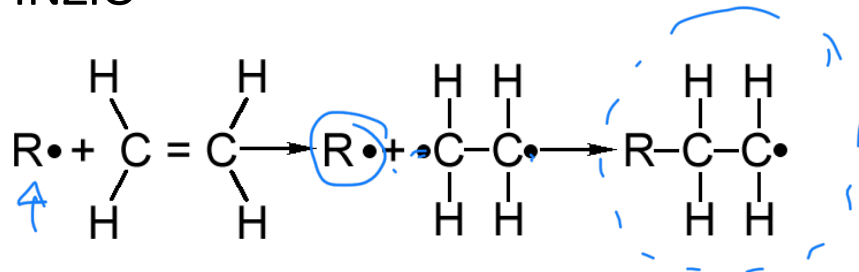
METALLOORGANICI



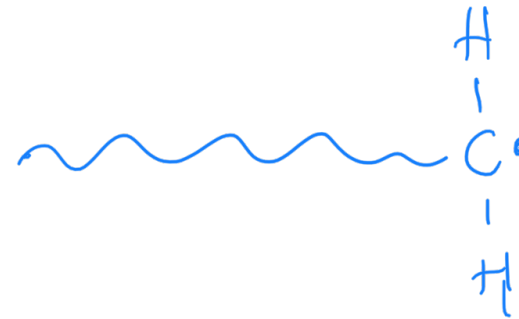
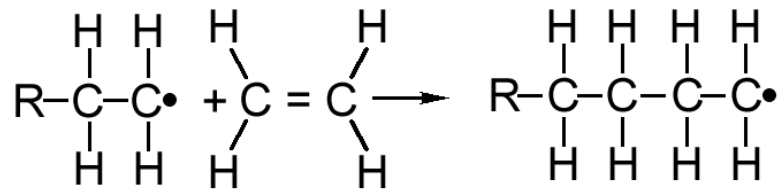
REAZIONI A CATENA: RADICALICA

POLIETILENE

INIZIO



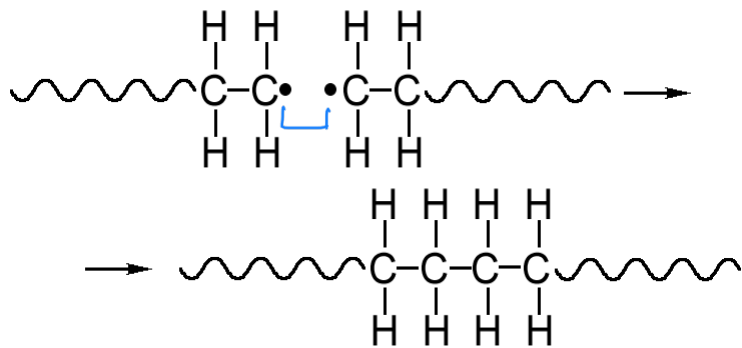
PROPAGAZIONE



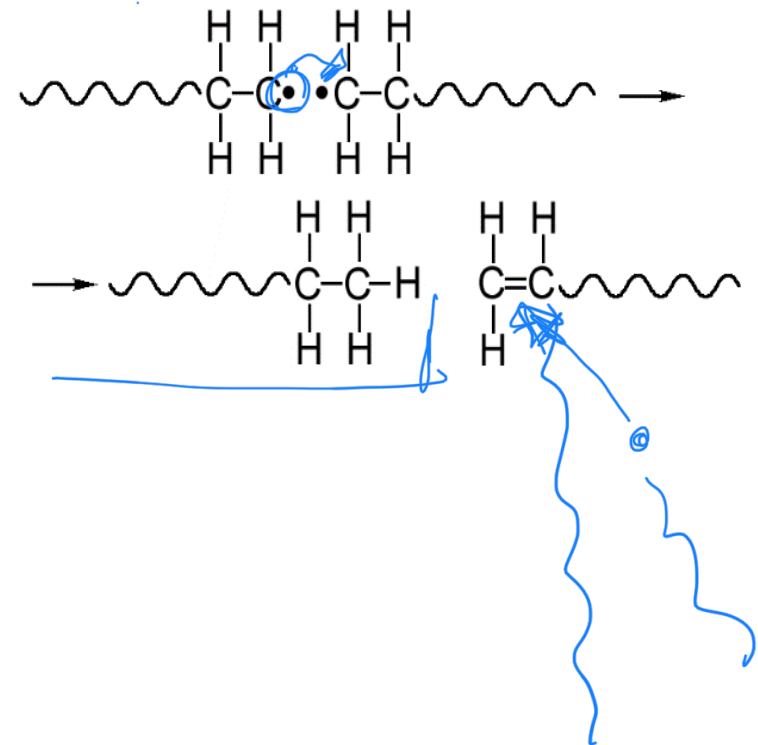
REAZIONI A CATENA: RADICALICA

TERMINAZIONE

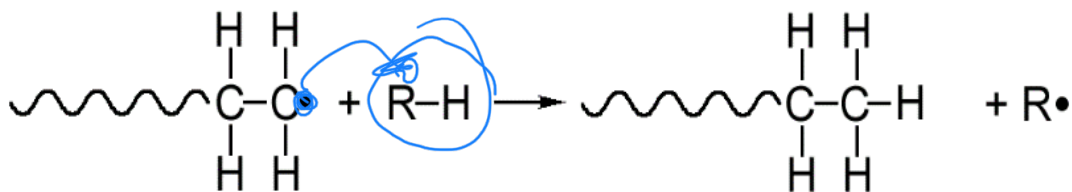
1. Combinazione di radicali



2. Disproporzionamento



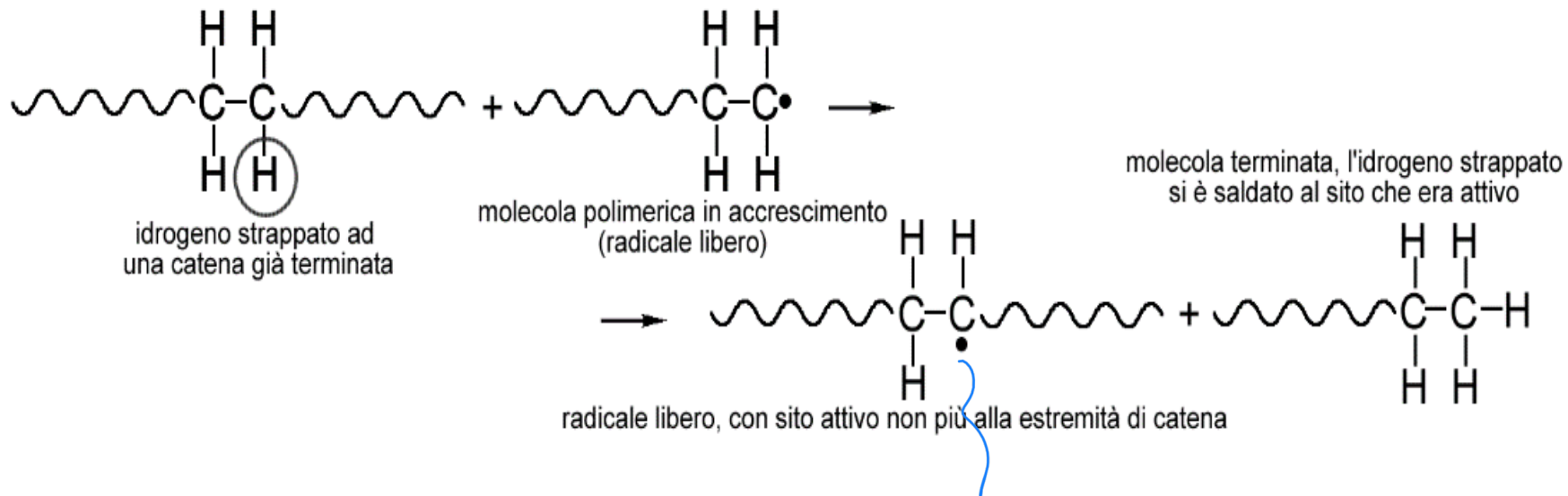
3. Trasferimento di catena



REAZIONI A CATENA: RADICALICA

TERMINAZIONE

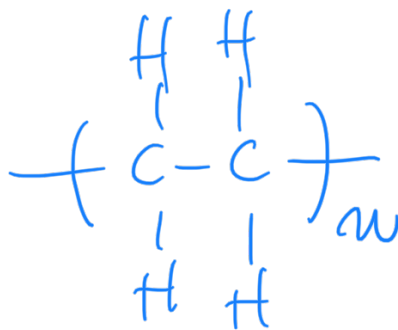
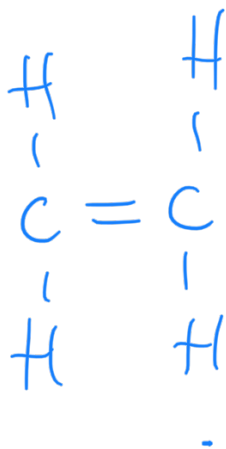
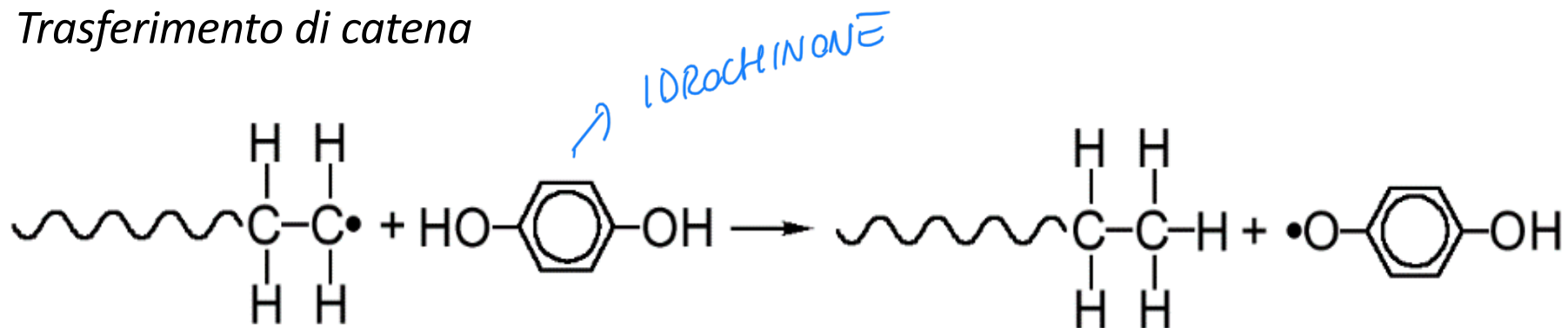
3. Trasferimento di catena



REAZIONI A CATENA: RADICALICA

TERMINAZIONE

3. Trasferimento di catena



↓ grado di polimerizzazione