Polymer ①

⇒ **Polyamide** → which have amide linkage

Prep → By the condensation polymerization of dibasic acid with diamines or their equivalents

→ These polymer commonly called **nylon**

ny → Newyork , lon → London

commonly used nylon is nylon-66

① Nylon-66 → Nylon fibre

prep Adipic acid + $(CH_2)_6N_4$

↓ condensation polymerization

Salt $\xrightarrow[525\,K]{\Delta}$ Nylon-66

under Pressure

$-H_2O$

$$n\,HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH$$

Adipic

+

$$n\,NH_2-(CH_2)_6-NH_2$$

Hexamethylenediamine

$$\text{Salt} \xrightarrow[\text{Polymerization}]{525\,K} \text{Nylon-66} + nH_2O$$

$$\left\{-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-NH-(CH_2)_6-NH-\right\}_n$$

Nylon-66

66 → since both have 6, 6 carbon

① Nylon-6,6 (sixteen) → nylon fibre

② Nylon-610 → [1972] commonly used.

prep Hexamethylene + dibasic acid (Sebacic acid)

↓

Product

$$n\ NH_2-(CH_2)_6-NH_2 + n\ HOOC-(CH_2)_8-COOH \xrightarrow{\Delta,\ \text{polymerisation}} \left\{NH-(CH_2)_6-NH-\overset{O}{\overset{\|}{C}}-(CH_2)_8-\overset{O}{\overset{\|}{C}}\right\}_n + n\ H_2O$$

Sebacic acid

Nylon-610

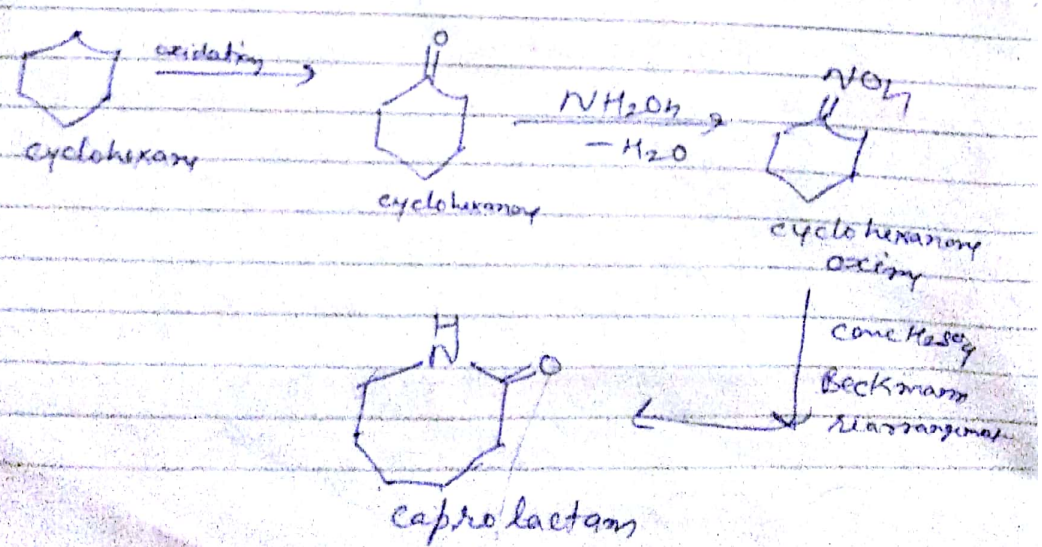
Use book

③ Nylon-6 or Perlon

$$\text{Caprolactam} \xrightarrow{\text{Polymerisation}} \text{Nylon-6}$$

C monomer

caprolactam को cyclohexane से oxidation से बनाते



(3)

caprolactam $\xrightarrow[\Delta]{H_2O}$ $[{}^{+}H_3N-(CH_2)_5-COO^{-}]$ ε-Aminocaproic acid

caprolactam → has 6C so final product को nylon-six कहते हैं

ε-Aminocaproic acid → Δ, Polymerization, −nH₂O

$$-\left[-NH-(CH_2)_5-\overset{O}{\overset{\|}{C}}-\right]_n$$

nylon-6

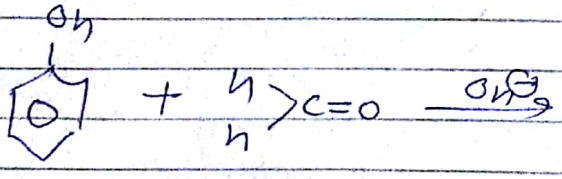
⇒ Formaldehyde resins → It contain polymers like, bakelite, melamine-formaldehyde, Urea formaldehyde etc.

(1) ~~Phenol~~ Phenol formaldehyde resin (Bakelite) → इसको phenolic resin भी कहते हैं

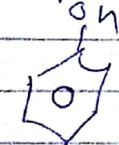
phenol + HCHO $\xrightarrow[\text{catalyst}]{\text{Basic}}$ Linear or cross-linked polymer

↓

It is called phenolic resin or phenol formaldehyde resin



O-Hydroxy methyl phenol



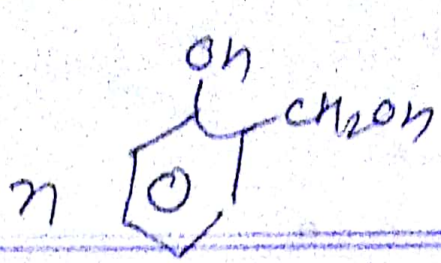
This process involve formation of methylene bridges either at o- or p- position or both at o- & p- position with respect to the phenolic group.

→ Initial product is Novolac + HCHO

↓ further heat

Bakelite

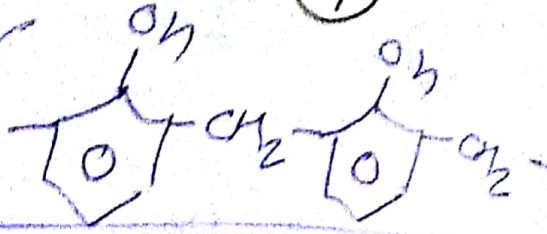
(3)



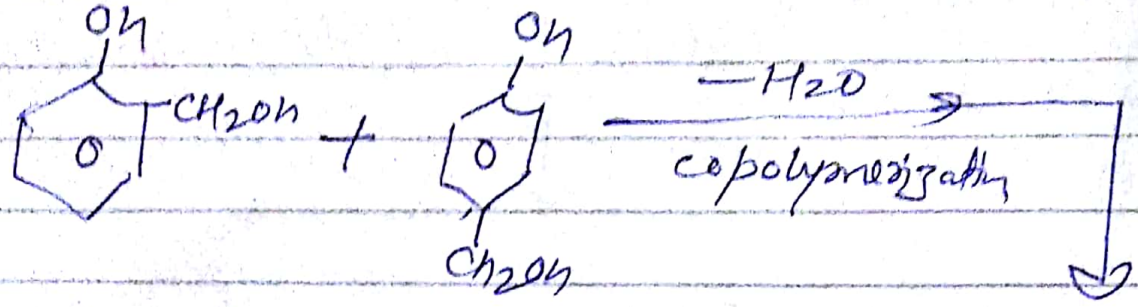
Polymerization

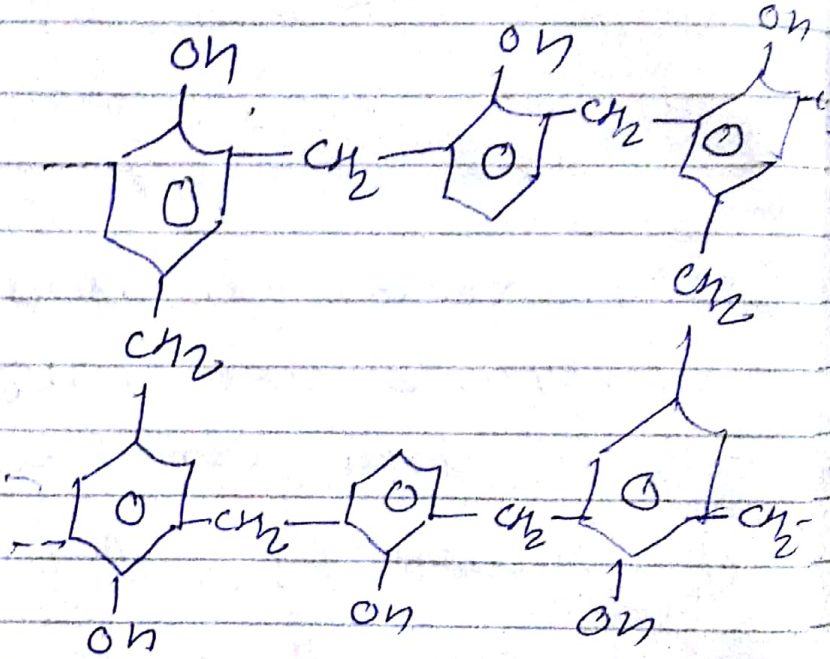
$-(n-1)H_2O$

(4)



Novolac (linear polymer)





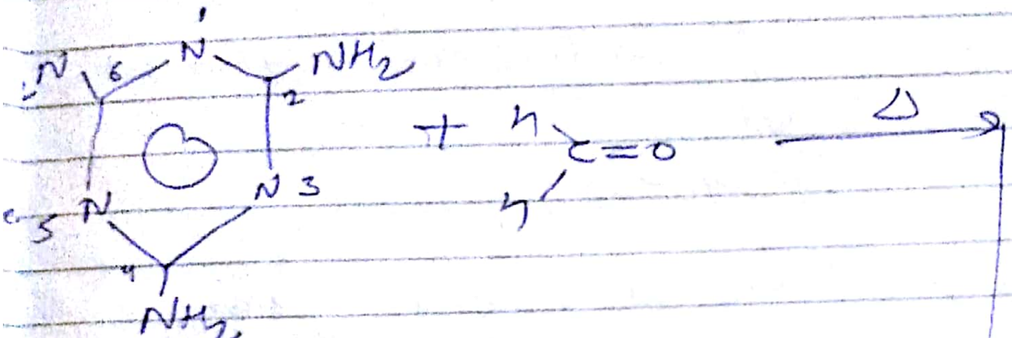
Bakelite (cross linked polym

(B) (5)

NRU → Non-breakable plastic crockery and n use

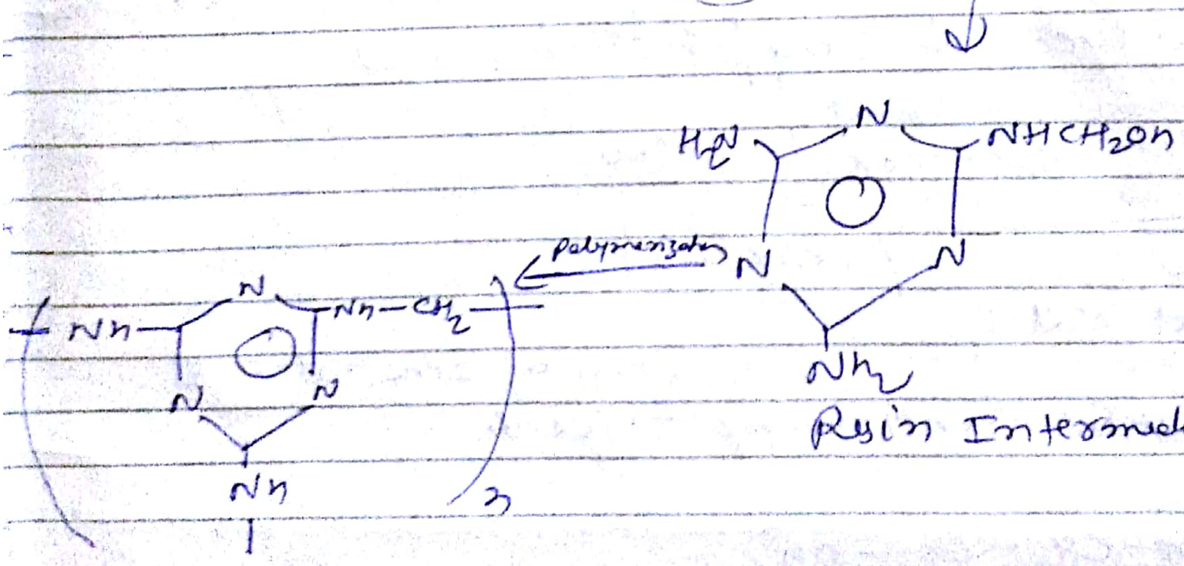
1) Melamine - formaldehyde resin

prep → Melamine + HCHO —copolymerisation→ Melamine - formaldehyde resin



Melamine

2,4,6-triamino-1,3,5-triazine



Resin Intermediate

Melamine - HCHO Polymer.

→ ester linkage (6)

(X) Polyesters → वे polymer जिनमें ester linkage होती है

Prep → Diacids + Diols

↓ condensation polymerisation

(Polysters)

Two Imp Polysters polymers are as-

(1) Terylene or Dacron →

By condensation polymerization of ethylene glycol & terephthalic acid

catalyst, 420-460K, △ at, $-H_2O$ ↓

Terylene

Used catalyst → mixture of zinc acetate & antimony trioxide.

$$n(OH-CH_2-CH_2-OH) + n\left(HO-\overset{O}{\overset{\|}{C}}-C_6H_4-\overset{O}{\overset{\|}{C}}-OH\right) \xrightarrow[-nH_2O]{420-460K} \left[O-CH_2-CH_2-O-\overset{O}{\overset{\|}{C}}-C_6H_4-\overset{O}{\overset{\|}{C}}\right]_n$$

ethylene glycol + Terephthalic acid → Terylene or Dacron

(VIMP)

2) Glyptal or alkyd resin →

prep →

Di basic acids or their anhydrides
+
Polyhydric alcohols (as ethylene glycol, glycerol etc)

condensation

polymer → इस प्रकार polymer को ही glyptal कहते है

→ सबसे Simplest glyptal ~~polyethylene~~ is poly (ethylene phthalate) होता है

prep → ethylene glycol + phthalic acid
condensation
Poly (ethylene phthalate)

(a) $n(HO-CH_2-CH_2-OH)$ + n (HOOC, COOH on benzene ring)
ethylene glycol — phthalic acid

$\xrightarrow[-n\,H_2O]{\Delta}$

$-\left[O-CH_2-CH_2-O-\overset{O}{\overset{\|}{C}}-\text{C}_6\text{H}_4-\overset{O}{\overset{\|}{C}}\right]_n-$

Poly (ethylene phthalate)

Polyhalo-olifins

(a) Polyvinyl chloride (PVC) →

↓ Vinyl chloride $CH_2=CH-Cl$ से बनाते हैं।

Reaction → Peroxide की presence में vinyl chl... polymerise होकर PVC बनाते हैं

$$n\ CH_2=\underset{\underset{Cl}{|}}{CH} \xrightarrow{\text{Peroxide}} -CH_2-\underset{\underset{Cl}{|}}{CH}-CH_2-\underset{\underset{Cl}{|}}{CH}-CH_2-$$

Vinyl chloride (Monomer)

or

$$\left(CH_2-\underset{\underset{Cl}{|}}{CH}\right)_n$$

PVC

↳ **Prep of Vinyl chloride**

$$CH\equiv CH + HCl \xrightarrow{Hg^{2+}} CH_2=CH-Cl$$ (addition reaction)

(or)

$$CH_2-Cl-CH_2-Cl \xrightarrow{873-923K} CH_2=CH-Cl + HCl$$

ethylene dichloride

Uses

Ionic polymerisation

Ionic polymerisation

2 categories

- Cationic
- Ionic

Cationic polymerisation →

↳ In this initiators & monomers are used dur the chain growth.

→ Initiation is done by a proton

↳ Propagation is carried out by a carbonium io

↳ In this used initiators → Strong Lewis acids as BF_3, $SnCl_4$, $TiCl_4$, & $AlCl_3$, S-E catal

↳ Used monomers are — Styrene, methyl styre & many Vinyl ethers & isobutylene.

process → Chain reaction | Initiation step →

(i) $[BF_3OH]^{\ominus} H^{+}$ + $CH_2 = CH - X$ → $CH_3 - \overset{\oplus}{C}H - X$

(a) Proton (Initiator) (Monomer Unit) (Carbonium ion)

(ii) ~~Initiation step~~

(ii) $CH_3 - \overset{\oplus}{C}H - X$ + $CH_2 = CH - X$ → IInd Monomer molecule

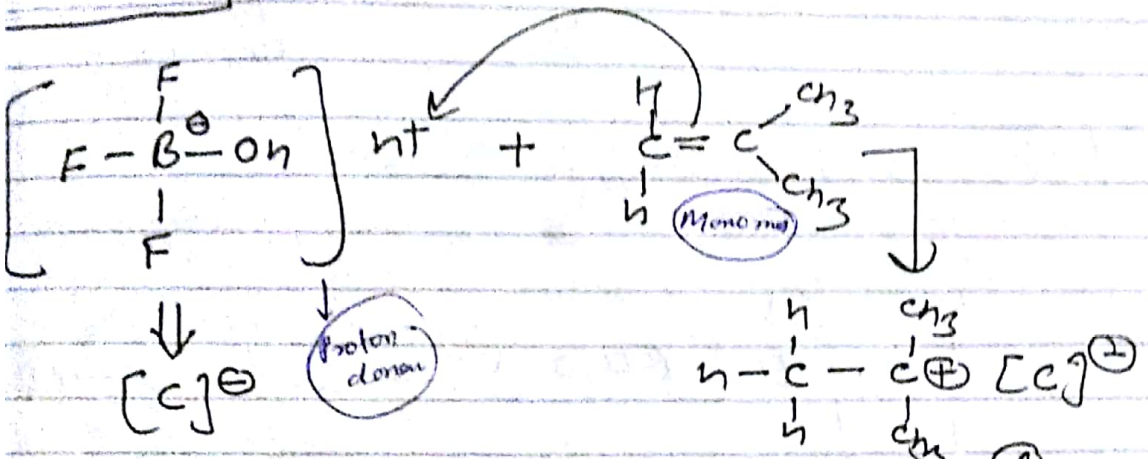
$CH_3 - CH - CH_2 - \overset{\oplus}{C}H - X$

(10)

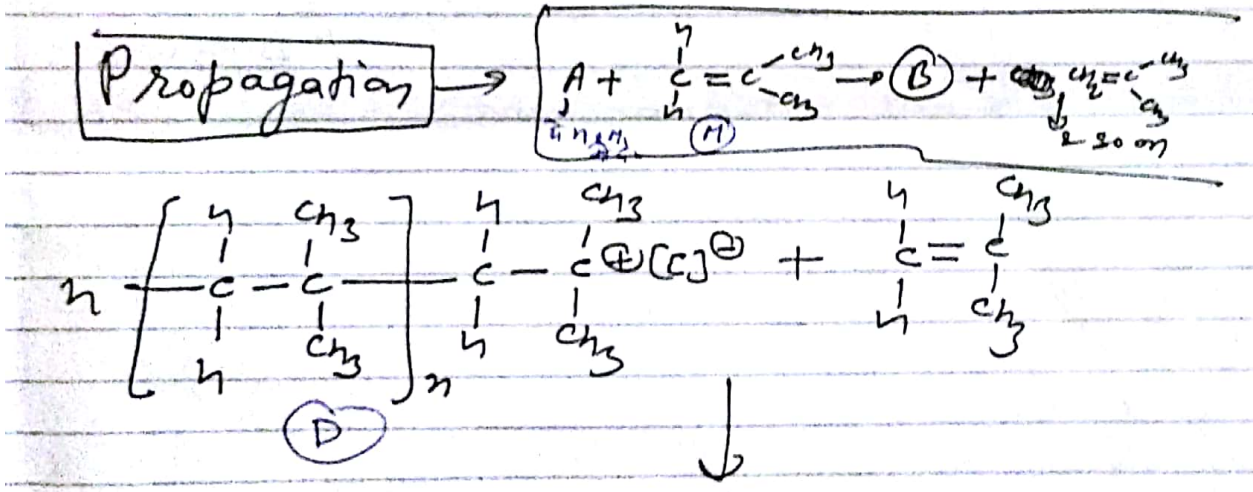
$BF_3 + H_2O \rightarrow [F-B(F)(F)-OH]^- H^+$

(A) Counter ion

Initiation → formation of initiator



Propagation →



Termination → chain transfer