Polymen Chemistry

Polymer: Polymen is a macro molecule.
macro molecule = Huge molecule.

poly = several ; men = molecule en unit

Below 20 micros playtic is harmful.

Milk packet - 40 micros.

Polymerisation:

The several number of monomens (small molecules) are combined together to form a polymen the process is called "polymenisation".

Degree of Polymerisation?

The number of monomers are involved in a polymerisation is called. " Degree of polymerisation".

It is denoted by n'.

n.CH2=(H2 Poly) - (CH2-CH2)

Mechanism &

--- + CH2 = CH2 + CH2 = CH2+ CH2 = CH2+ ----

mich rample polyn

Monower. CH2-CH2-CH2-CH2-CH2

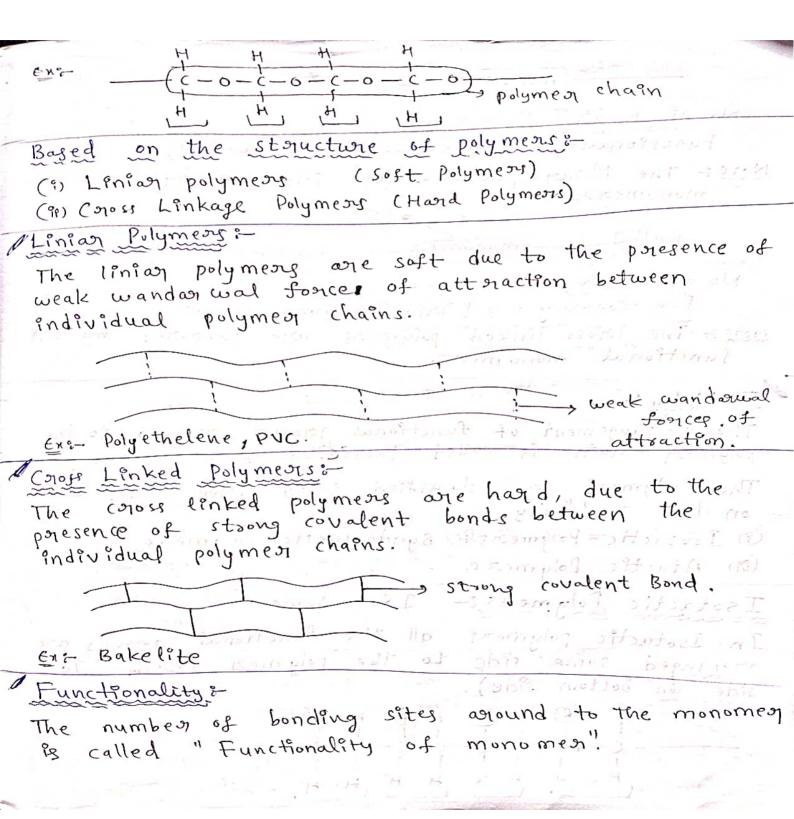
Polyethylene !

(on - [CH2-CH2]n

Monomer :- Repeating unit in a polymen is called monomen.

| Types of Polymens? |
|---|
| Based on the nature of monomers? |
| (9) Homo Polymers (Pr) Co-Polymers. |
| Homo Polymers: |
| A polyment is made up of same monomens is cal |
| "Homo Polymers". |
| EX:- AAAAA |
| monomeg. |
| Co-Polymens: |
| A polyment is made up of different monomers is |
| called " co-polymens". |
| ENS ALBITALBI |
| monomen sice plante year to resolution |
| ARATHORIT DE TOPONO DE LO PORTO DE LA PORTO DEL PORTO DEL PORTO DE LA PORTO DEL PORTO DE LA PORTO DE LA PORTO DEL PORTO DE LA PORTO DEL PORTO DEL PORTO DE LA PORTO DEL PORTO DE LA PORTO DEL PORTO DEL PORTO DEL PORTO DEL PORTO DE LA PORTO DEL |
| Based on the nature of polymen chain: |
| (i) Homo Chain Polymen (kr) Hetero Chain Polymen. |
| Homo Chain Polymerii- |
| In a polymen the polymen chain is made up of |
| same atoms is called "Homo Chain Polymen". |
| ENS- HHHHHHH |
| Polymer chain. |
| H H H H H |
| Hetego Chain Polymeni |
| In a polymen the polymen chain is made up of |

different atoms is called "Heterro Chain Polymen".



Bonding Ste Bonding site mono men No of bonding sites = 2 Functionality = 2 [Bi dunctional monomen]. Note: The liniar polymers are prepared by bifunctional monomens. Bonding site - Monomer - Bonding site No of Bonding sites = 3. Functionality = 3 [Tai - Functional monomers] Note: The cross linked polymers are prepared by the functional monomens. Tacticity -The arrangement of functional groups around to the polymen chain is called tactivity of a polymen The polymeous one classified into thosee types based on the tacticity. (9) Isotactic Polymers (4) Syndiotactic polymers. (in) Atactic Polymers. Isotactic Polymens: Iso = same In Isotactic polymers all the functional groups are anongaged same side to the polymen chain (Top side (on bottom side). H (B) H (B) H (B)

Syndio tactic Polymens: syndio = alternative

In syndiotactic polymers all the functional groups are analouged in the alternative positions around to the polymen chain. T 98 04 1 10 20

atactic = random (zig zay). Atactic Polymers:

all the functional groups are In atactic polymers positions around to the polymen annanged in mandom chain.

Types of Poly mezisation: (9) Addition poly messisation on Chain growth poly"

(%) Condenstation polymenisation

(%) (o-polymerisation.
(%) (o-ordination polymerisation.

Addition Poly meanisation:

Several number of same unsaturated (= @=) monomens on polymenisation (poly") in the presence of heat (or sun light (or catalyst (or pressure to form addition polymens without elimination of any by-paroducts, the parocess is called addition polyn.

The poly paroceeds through chain growth mechanism so it is also called chain growth polymerisation. In addition poly" the liniar polymers are prepared. Several no of Poly Addition + No BA-brayage Same unsaturated Heat on sunlight polymer 5 Rymonon Con Catalyst con pressure Exiti) Poly ethylene Polyethylene is the polymen of ethylene. $N \cdot (H_2 = (H_2 \longrightarrow N \cdot - (H_2 - (H_2$ Ethylene Bi-functional Polyethylene (P) Poly vinyl chloride - PVC PUC is the polymen of vinyl chloride. $n \cdot cH_2 = cH \longrightarrow n \cdot - (H_2 - cH - \frac{Poly^n}{ct}) = \frac{CH_2 - CH}{CO}$ Vinyl chloride Bi-tynctional 1. CH2 = CH - - This is vingl group. (999) Polystynene. Polystyrene is the polymen of styriene. N. CH2 = CH -> N-- CH2- CH- Polyn - (H2-CH) For Abitomorphism Dez

Styrene Bi-functional polystyrene.

you lithou hallow as a word gate , extra

Condensation Polymenisation: --

Several number of same on different monomens having two (on more functional groups on polyn in the presence of heat to form condensation polymens with the elemination of by-products, the process Ps called condensation poly". The poly" proceeds through step growth mechanism so it is also called step growth polymerisation.

The cross linked polymens are prepared by condensation poly".

TO JUST EAST OF TURE!

Mechanismo-

 $A-X+Y-B \longrightarrow (A-B)+XY$ - Dimen SNE DE Tail - Eil.

 $(A-B)+(A-B) \longrightarrow (A-B)_2 \longrightarrow$

 $(A-B)_2 + (A-B) \longrightarrow (A-B)_3$

Tetogamen Dimen Hexamen. (6-03) distant Polymenti all of

 $(A-B)_3 + (A-B)_n \longrightarrow \overline{+A-B}_n$ [33 14 + 1097] polymen Hexames.

Exo Nylon-6,6.
Nylon-6,6 is the polymen of adiptic acid and hexa methylene diamine.

NHOOC - (CH2) - COOH + N. H2 N - (CH2) - NH2 adipie acid | Hexa methylene diamine Nylon-616.

- (CH2)4-CO-HN-(CH2)6-NH = + 8 m. H20

Co-Poly merisations

Several number of different unsaturated monomers on polyn in the pressence of heat to form co-polymers without elimination of any by-products, the process is called co-polymerisation.

The rubber polymens are prepared by co-polyn

En: Bang-S 746berg.

Bung-s rubber is the polymen of 1,3-Butadiene and styrene.

-mil make

n. ch=ch=ch2 + n. H2C=CH

1.3-Butadrene Stynene O

 $\frac{\Delta}{\Box} \longrightarrow \frac{CH_2 - CH_2 - CH_2 - CH_2 - CH_3 - CH_3}{Bunq-S} \longrightarrow \frac{CH_2 - CH_2 - CH_3 - CH_3}{\Box}$

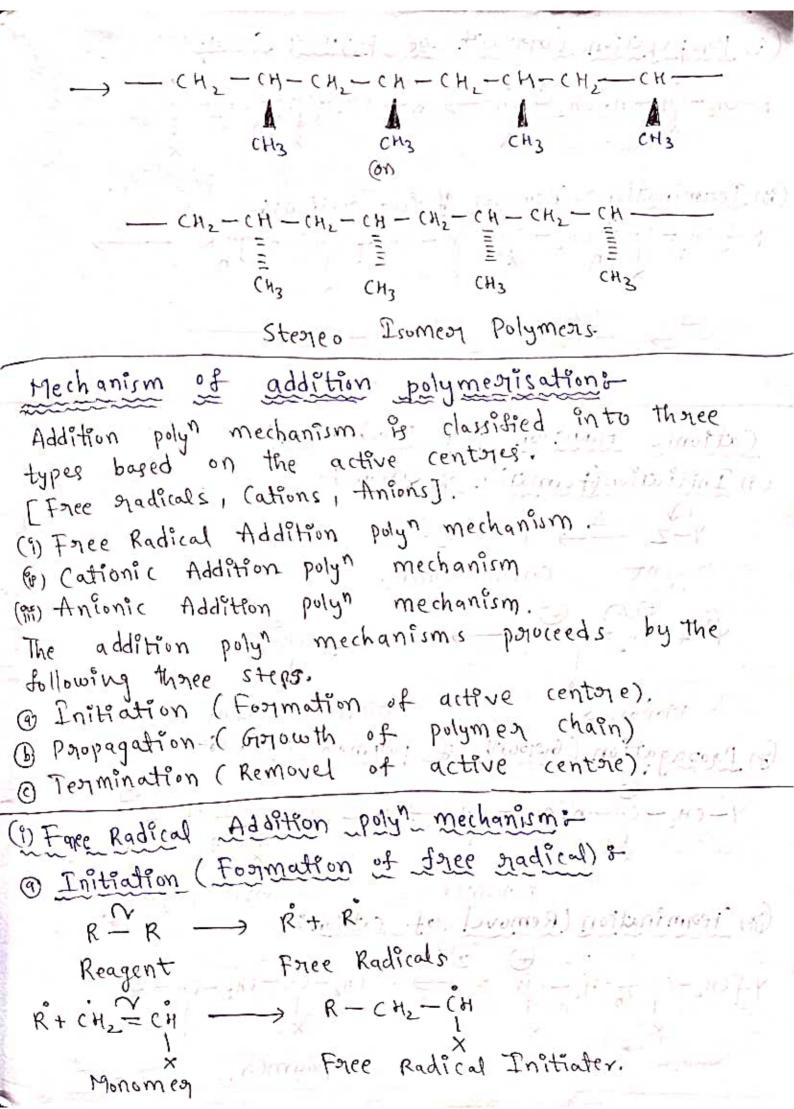
Co-ordination Polymerisation?

[Ticly + Al Et3] [Et = Ethyl . - (H2-(H3) Zieglesy-Natta Catalyst.]

several numbers of unsaturated monomers on poly" in the presence of Zegler-natta catalyst to form stereo isomer polymens.

 $\frac{\text{Ext}}{\text{N.CH}_2} = \frac{\text{CH}}{1} + \frac{\text{Poly}^{\text{N}}}{\text{Trcly}} + \frac{\text{Poly}^{\text{N}}}{\text{REE}_{3,1}} + \frac{\text{Poly}^{\text{N}}}{\text{Poly}^{\text{N}}}$

prophylene fine (H) - of - of - of - of



| (3) Propagation (Growth of polymen chain)? |
|--|
| $R-iH_2-iH_2-iH_3-iH_2=iH_3-iH_3-iH_3-iH_3-iH_3-iH_3-iH_3-iH_3-$ |
| (97) Termination: - (Remove) of free radicals polymen. R f CH - CH + CH - CH + CH - CH (Ch) Ch + Ch - |
| $R + (H_2 - (H_1) + (H_2 - (H_2 + (H_1 - (H_2 + (H_1 - (H_2 + (H_1 - (H_2 + (H_2 + (H_1 - (H_2 + (H$ |
| $\xrightarrow{\Delta} CH_2 - CH - CH_2 - CH_2$ |
| - Sincilar Pennox. Xive offer to influence |
| Cationic Addition poly Mechanism |
| (1) Initiation (formation of Cation); |
| $y-z$ Δ $\varphi + z\Theta$ invitibals harby |
| reagent cation anson. |
| At the the many - the the month of the many of the |
| Monomer. (ation instrator |
| (&) Dropagation (Growth of polymen chain): |
| (f) |
| 1-CH2-CH+N.CH2=CH ->1,7 f CH2-CH - CH |
| XI (the letter & XIII be contained to |
| (gr) Teamination (Removed of cation o |
| Θ Z^{Θ} |
| 4-f(H2-CH-CH-CH-CH-CH-CH-CH-CH-CH-CH-CH-CH-CH- |
| × × × × × × × × × × × × × × × × × × × |
| to the land of polymen. |

Anionic Addition Poly mechanismi (p) Initiation (Formation of anion) & Y-Z -> YO + ZO Reagent. (ation Anion $Z^{\Theta} + (H_{2} = (H \longrightarrow Z - (H_{2} - (H \bigcirc H)))$ Monomez Anionic Initatoz. (#) Propagation (Growth of polyment Chains $Z-CH_2-CH+\eta\cdot CH_2=CH) \rightarrow Z+CH_2-CH+CH_2-CH$ $X \qquad X \qquad X \qquad X$ Anionic Polymear. (89) Teamination (Removel of Anions) & $z = (H_2 - CH_2 - CH_$ ola X polymen. Plastics: The plastics one classified in to 2 types Theormoplastics:

(9) Theormoplastics

(8) Theormo setting plastics. The plastics which are become to soft on heating and they become to hard on cooling are known as theor mo plantics. plastic ____ soft ___ cooling > Hard: 100 Hard: of id for man Lating prints wing Properties: O Theormo plastics are soft, weak and less brittle. 3 The Individual polymen chains are held together

| by weak wanday wall attraction sonces. |
|--|
| -M-M-M-M- weak wandar wall -M-M-M-M-M- attraction-torice. |
| Theormoplatics are consider as liniar polymens |
| Theomoplastics can be neighbed from their waste. |
| (1) Theormosetting plastics of the hard on heating |
| the playtics which are become known as but not soft on cooling are known as theormosetting playtics. |
| Plastic - Mara. Le lucines de la |
| District are hard, storage and more brittle. |
| The individual polymen chains are held together by stylong covalent bonds. |
| -M-M-M-M-Strong Covalent bonds. |
| 3) Theoremosetting plastics are considered as cross |
| linked polymens which age prepared by condemation polyn. |
| (Theomosetting plastics can not be orecycled from |
| their woste. ext Bakelite. |

between they moplastics a:- Waite the difference and theormo setting plastics. Theamosetting plastics. solo Thermoplastics OThe plastics which are O The plastics which are become to hard on heating become to soft on heating but not soft on cooling and they become to hard Thermoretting plastics. on cooling age known as they mopley tics. 2) Theopmosetting plastics are 2) Theormoplastics are soft, hard , strong and more weak and less brittle. 3 The Individual polymen 3 The Individual polymen chains are held together chains one held together by strong covalent bonds. by weak wandar wall attoraction forces (4) Theormosetting playtics are (4) Theomoplastics are consider as cross linked consider as liniar polymens polynery by condensation polyn (which are prepared) which one prepared by addition polyn, 3 Thermosetting plastics (5) They mo plastics can be recycled from their waste can not be recycled from their waste. genture om ter & Bakelite. I'd prov 1) ext puc, polythene -5232 Fedion It west for making system -INT W 12989 Evily been to imon's one freshow it may bear underly wow there is one 5N/ (7)

ETISKED TO 24 TON- GOTE BUSHOM TOT 1500 2 (NOLSOT (199)

· Halayor to the target the shiften to @. Write preparation, properties and uses of Teffon. Sole Polytetora Floro Ethylene = Teflon. Prepayation & Testion is prepared by the polyn of tetra store ethylene in the presence of benzoyl perforide as catalyst under pressure. Benzoyl poronide (Tetra Floro Ethylene) (poly-Tetra Floro Ethylene) Poropeaties & (1) The teston structure is similar like polyethylene. But, the property are not similar. (91) The storong attoractive forces present between individual polymen chains of teston due to the pressence of highly electro negative florine atoms.
(39) The strong attractive forces makes the teston

@ High Chemical oresistance.

Usy 6-

on The teston is used for making gasket wines and chemical casalying pipes.

(it) The teston is used for making non-stick (ook

wareg.

(Pi) Teston is used for making stop-coaks of busiettes.

| (90) Teflon is used for making electrical insulating wire |
|--|
| Q. Write the preparation and uses of PVC? Sylo PVC = Poly Vingl Chloride. |
| The PVC is perepared by the poly" of Vinyl Chloride in the presence of hydrogen peroxide (H2O2) as catalyst under pressure in an autoclave. |
| n.cH2=cH Polyn -fcH2-cH Add of che CH2-cH - playthingery -fcH2-cH - playthingery -fcH2-cH - playthingery playthingery playthingery playthingery Plexible PVC. |
| Paropenties & solventier powder selver |
| (9) PVC 18 a non-Problemable and highly chemical (9) PVC 18 a non-PVC 1 |
| Unplasticized PVC & wed for making resignation |
| PVC pipes etc. |
| Productive capter, carpets, sign coats, tank linkings |

@. Write the preparation properties and uses of nylon? 2018 Nylon is a synthetic fibre. The various nylong are named based on the number of carbons balezent in each monomeal -Lackation & Nylon-616 & the polymen of adipic acid and hera. methylene diamine, was abor on the story than n. HOOC - (CH2)4-(OOH + n. H2N-(CH2)6-NH2 adipic acid -Hzo \ \D , hexamethylene diamine. -- foc-((H2)y-(0-HN-((H2)6-HH-)n +20. H20 Nylon - 616 Nylon-62 Nylon-62 the polymen of amino capacic acid. n. HHN - ((H₂)₅-(00H self cond roly) — EHN-((H₂)₅-(0 J_n + n. H₂) Amino Caproic acid Nylon-6.

Poroprosties &

(?) Nylon ? a very strong and light wt material.

(B) Nylon possess good mechanical properties and aborassive resistance of Just president soil. (m) Nylon exhibits both dibale and plastic forms. Uses 8-Mylon-6,6% It is used for making table cloths, rain coats, socks, under garments, dozensen, lady shoes, parachuts, satty cay also bage, army tents,

umborella, boistiles of tooth bresh, films -- etc. Nylon-6: It is used for making moulded materials for gares and barings.

Bakelite ?

@. Write the preparation, peroperties and uses (applications) of bakelite.

Solb Pore postation -

Step-18 The eccess of phenol reacts with formaldehyde in the presence of acid on base catalyst to form Ortho-Hydroxy Methyl Phenol (OHMP) and P-HMP.

Step-22 n' nymber of ortho-HMP on condensation polyn to soom novalac which is a linear polymesy

FN TOM Spanned SAT OH JOH

Novalac (Lingay polymen)

Step-3: Novolac is heated in the poresence of hexa methylene tetra amine which porovides formaldehyde which are formed between polymen chains as methylene linkages. The methylene linkages makes the novolac polymen hard and niged which is known as "Bakelik" O-CH2 OH OH OH OH OH OH OH OH OH CHONDAC (Cha) Noy OH OH OH Bakelite Cross Linked polymer) Popopeontiers hard regid and indusible cross linked boldwed. (A) Bakelite has good Problating capacity. Uses 8-(8) Bakelite By used for the manufacturing of electrical eccupements loke switcher switch boards, plugs, holders (91) It is used for making TV, refriggrator componentie (999) It is used in parate and wornishes.
(90) It is used as a cation exchange stessin in water sofething process.

| Elastomers (Rubbers) à |
|--|
| Rubber Ps quailable in two 19ps. (9) Natural Rubber, (8) symphetic Rubber. |
| 1 Lugal Rubberg & |
| The 'n' number of Esoporenes on poly by 1,4-addition to form poly Isoporene, which is known as natural |
| M3 |
| n.ch = c-cH=CH2 Poly - (H2-c=CH-CH2-I) |
| Is up orene. Poly Isopolene. |
| (National Rubber) |
| Synthetic Rubberg ? |
| (Buna-S Rubbergo Buna-S (Buna-S and user of Buna-S (B. Haffe the pareportation, paroperties and user of Buna-s |
| (a). Hatte me 1 10 10 10 20 10 20-11-11-51 20 |
| MILL 1 1 0.71 |
| Buna-S symboly 18 The polymen of 173-but a diene (45%) and styrene (25%). |
| and styrene (25 %). |
| n.(H = (H - CH = (H) + n.CH = (H) |
| 1/3- Butadiene (25%) |
| $-\int CH_2 - CH = CH - CH_2 - CH$ |
| |
| Runa-S (on OTK-) |
| properties a trad grantitude for and because capacity |
| (9) Buna-5 sylber has hegh load bearing capacity. |
| (31) It has abjusion resistance. |

(189) It swells in oils and organic solvents. Con It oxidises in presence of ozone.
Con It is vulcanized in the same way as natural siupped. Use & (3) Byna-s grubben is mainly used for manufacturing of types. (ii) It is also used for making shoe soles, floor tiles insulating cables, gaskets, tank linings etc. Bung-N Rubbears @. Write the preparation, properties and was of Bung-N onubbest? 50/8- Poreparations Bung-Ni rubber is perepared by the co-polymenisation of 1,3-Butadiene and acrylonitaile in the presence of 'Na' of catalyst. $U \cdot (H^{5} = cH - cH = cH^{5} + U \cdot (H^{5} = cH)$ 113-Butadiene Acaylonitaile CNJN Buna-N syubber Nitrile rubber (m GR-A. Poroperties: (9) Bung-N subbeg has oil resistance, heat resistance and abgrassion sysistamee L appearion cois seep Rough & Tough to wedgesty.

(ii) It has acid , salt resistance but attacked by alkalier (bases) due to posessine of -(N group. (97) It is vulcanized in the same way as natural

Uses &

(?) Bung-N rubben is used for making auto-mobile parts, and const components, conveyor belts, hoses, printing stolers, tank linings. etc.

Conducting Polymers.

@. Waste a note on conducting polymears? (on Types of conducting polymens?

sols The top polymers are the poop conductors of electarcity due to very large band gap (Enrugy gap). A few numbers of polymens possess the conductance because they can reduce their band gap as low as 0.5 - 1 eV, those polymens are called conducting polymens. it super la posmplag sitt.

Types of conducting paymens. Wight 20 navors

(e) T conjugated conducting polymers (1)

(17) Doped conducting polymers.

. Il conjugated conducting polymensis

The T conjugated conducting polymers possess the conductance es due to the delocalization of T-conjugated electations on the backbone of the entiste polymen which makes the polymen as conductor,

polyacetylene most mottobino la

poly any line

The T-conjugated conducting polymers possess less conductivity which is not sufficient for varies applications.

Doped Conducting Polymers.

The conductivity of T-conjugated conducting polymers can be encoreased by coneating the for the charges on the back bone of polymers by oxidation for reduction, the process of called doping and the polymers are called doping polymers.

p-dopings The process of creating the charges on the back bone of polyment by oxidation by known as p-doping.

n-doping & The process of coreating -ve charges on the back bone of the polymen by oreduction is known as n-doping.

Applications of The conducting polymean are used
(3) In solar cells, (8) In translitors, (88) In LED's,
(90) In telecommunication, (v) In display of mobiler, Trett.

On. Write the syntheses of poly acetylene.

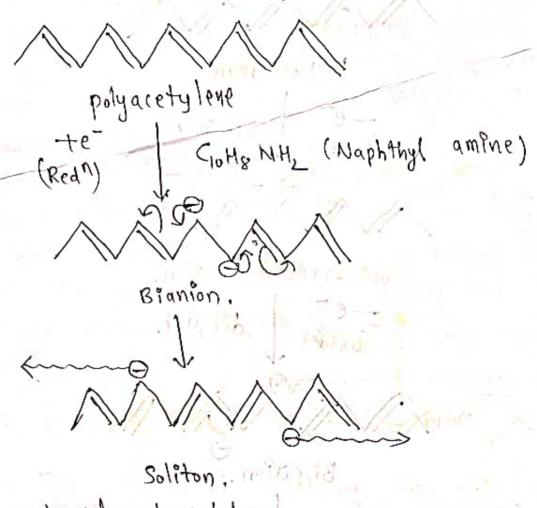
Ens. J. gobing 8

The polyacetylene & doped by the addition of lewis acid like dil. Hel which leads to oxidation.

In 1st oxidation forming radical cation and in 2nd oxidation forming Bi cation.

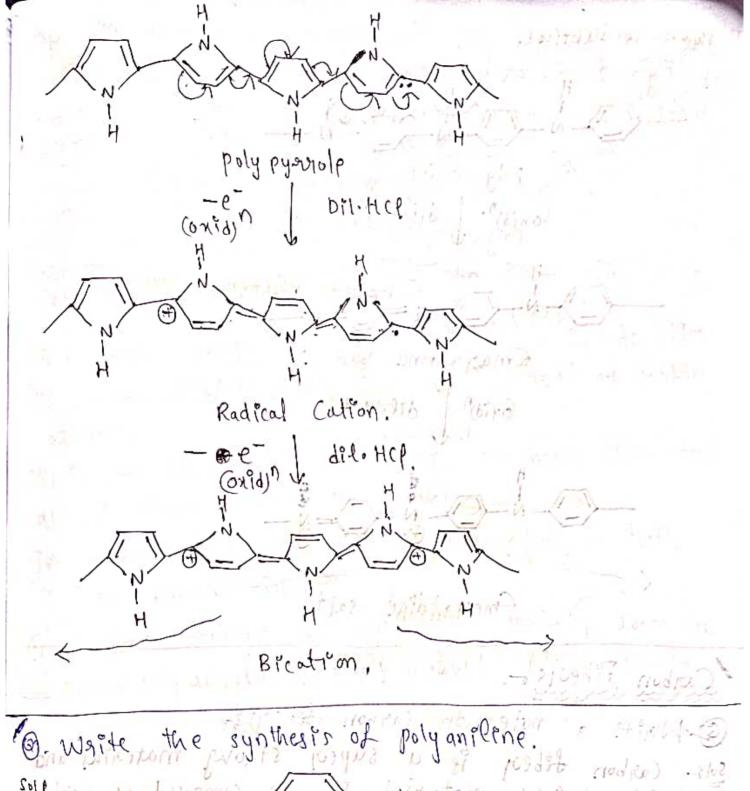
The tre charges one moving away from each other known of solfton. Which makes the polymen conductor. poly a retylene DH. HCA radical Cation. dil. Hel Bi cation .. mes and solitongols a goració p-doped poly acetylene. The poly acetylene is doped by the addition of lewis base like naptithy amine (CIOHSNH2) which leads and odline rapport to reduction. In 1st reduction forming radical anton and in reduction forming by anion.

The -ve charges on the polymen back bone movely away from each other known as soliton, which makes the polymean conductor.



n-doped polyacetylene.

Syntheses of Joly pysyole? @. Write the synthesis of polypysonole? 54 - The polypyrvole is doped by the aggetten of femis acid like gel. HCb which leads to oxidation In 1st oxidation, footming radical cation poppy pyrole -HPWIGOD-FI and In and oxidation toximing bication The tre charges on the back bone of the polypyrinole moving away from each other known as soliton which is exesponsible a foot conduction



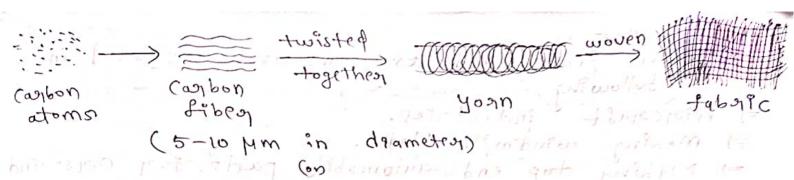
The tre charges on the poly aniline moving away

from each other known as soliton, which is responsible

for conduction. polyanillene CON98) . | 398.41. (>n-(>n-(>n-Emajaldine Base 64890 | 986- HC1 Emenddine salt Carbon Fibers: - Bereggig nodro on carpon giperis ? solo Carbon Lebest is a super strong material and light weight material. It is composed of carbon atoms which are bonded together to form carbon fibers. The thousands of carbon tibers twisted together to form your which are woven into fabili born 2200 Politicality ins particular hotel

the carbon fibers one mixed with other components to form carbon fiber composits.

oldismodrate is gramma is referent monitor is alsonizable



+ components ____ carbon disper composites. (asbon Le pears

- (8) Caybon fibers about 5 to 10 Mm in drameter.
 (8) Caybon fibers are composed of 90% of carbon . amoto
- (977) (asibon febeg is five times stronges than stee) and a temes lighter than steel.
- (iv) Carbon Liber is thinney than human hair (100 times thinner).
- (v) Caybon fibers are synthesized mainly from the PAN. (poly acrylo nitrile) method. Alternatively synthesized from rayon method (2) petroleum pitch method.

Paropenties &

- (9) Carbon fiber has high tensile strength and high stiffness.
- (ii) It has low they mad expansion.
- (PM). It has high chemical resistance.
- (Pv) It es a light weight material. It is a super strong material.

Applications: (e) Carpon diber and its composites are used in the followshy =) Aiorcolast "industries. -) Making windmill blades.

-) Making top end automobile points, for cour and bikes. =) Making light weight badminton nockets, golf s-ticks. Suppose.) Used an building and constantion pupose. (m) contract property simil out the party reduces (m) a sport of Joseph and Kathers someth & bas leint welling abut teaungh it had as modices (in) . (15 moint init on) aft most plassed besided modern (D) phonostin button (olinten office play). hat in where the transming method on pet- policien Boltsm- ditta proceed the sale of the policy to the leading works (i) high stiffnessmount of the makes by mester was fort II (a) (m. It has high chemical selltang. It of the first trigger to the property of the party of t - 1. latrotom revolet & figure a ti ti