simple addition at the double bond and and no free radical, carbanion. Carbonium is formed.

Monomer units are simply added one after another as in chain polymerisation to form a polymer without elimination of small molecule such as $H_2O$, $CO_2$, HCl etc.

The polymer is formed by the migration of a hydrogen atom from a monomer and its addition at the double bond. This process involves a high activation energy required than the free radical polymerisation process.

## Ring opening Polymerisation :-

* Monomer having a ring structure can be opened and polymerised if conditions are favourable. This 'opening up' is the opposite of the 'condensing process'.

* Some typical examples of ring opening polymerisation
Lactams, Lactones, cyclic ether, cyclic anhydride, Carboxy anhydride.

Ring opening polymerisation resemble chain polymerisation in the sense that it proceeds by addition of monomer units.

It also resemble step polymerisation in the sence that as polymer growth take place by step wise add of monomer unit.

### Cyclic ether :-

The polymerisation of eboxides such as ethylene and propylene oxide to high mol wt compounds can occur in many ways.

Lewis acid such as $BF_3$ give low mol wt polymer. so polymerisation of these epoxides are done by hydroxides, Alkoxides such as Sodium Methoxide ($NaOCH_3$).

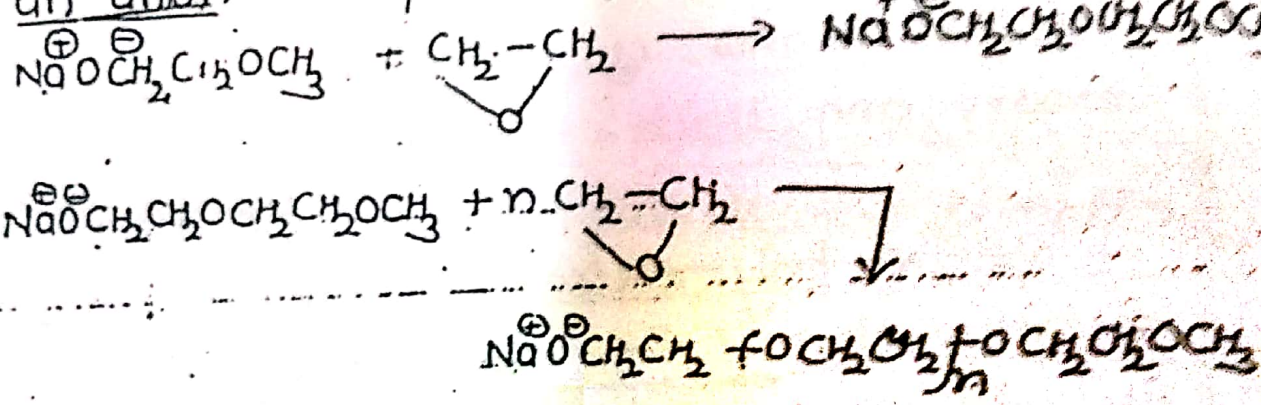
The polymerisation occurs in three stages.

(i) Initiation :-

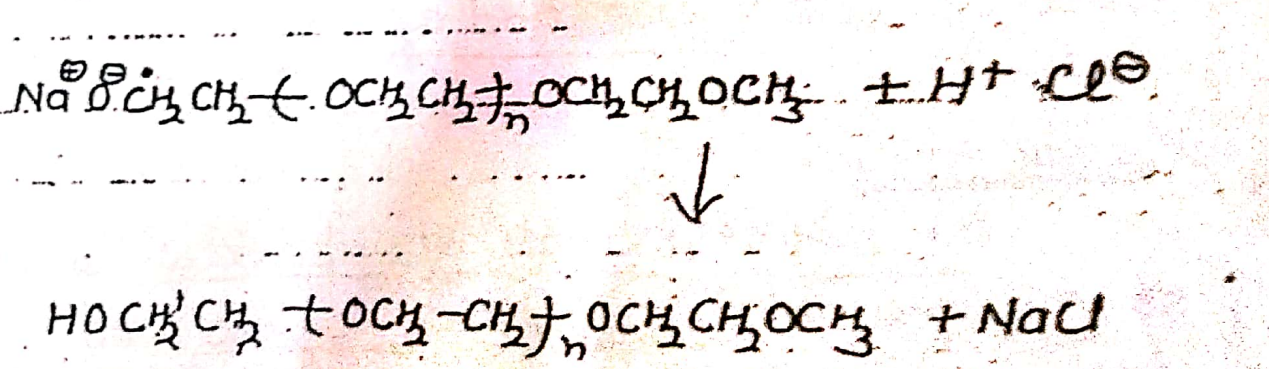
epoxide

In this initiation sodium methoxide attack the oxirane ring and cleave (break) the ring and form an anion.

(ii) Propagation :- The anion formed attack the ethylene oxide ring which will be opened and form an anion. This process goes on -



(iii) Termination :- It occur when anion is caged by adding a proton eg HCl.



But in case of unsymmetrical epoxide like propylene oxide it may occur that different polymers can form (depending upon the mode of opening of the ring)

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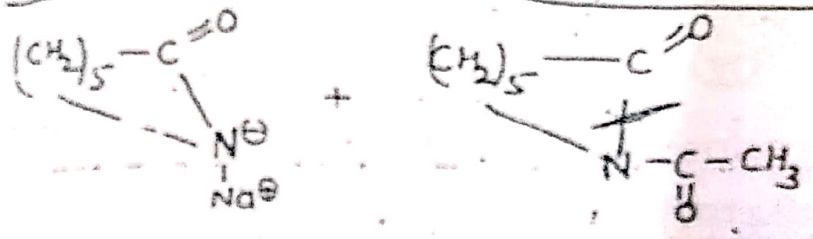
## (2) Cyclic amide (Lactams) :-

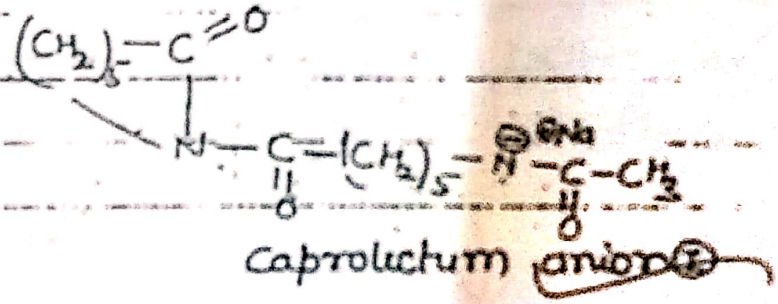
Ring opening polymerisation of Caprolactum form Nylon-6.

(i) Initiation :-

In this case sodium caprolactum and N-acetyl caprolactum (I) react and form the attacking anionic species called caprolactum anion (II)

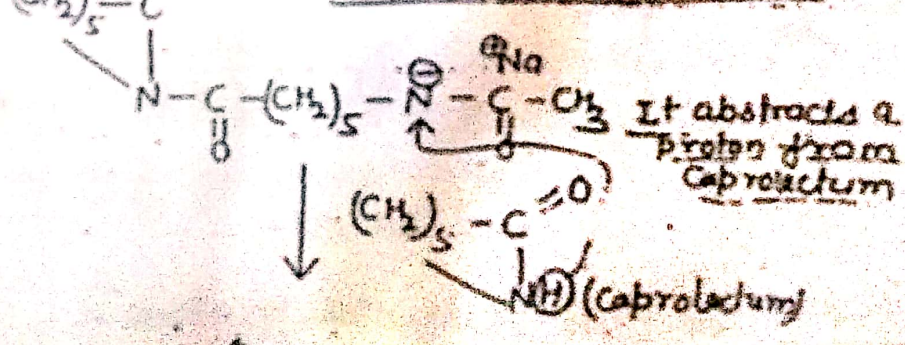


Sodium caprolactum  N-acetyl caprolactum



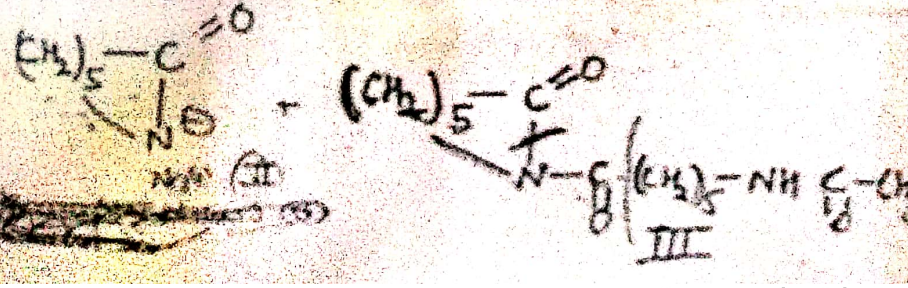
Caprolactum anion (II)

(ii) Propagation :- caprolactum anion attack on another caprolactum molecule.



It abstracts a proton from caprolactum

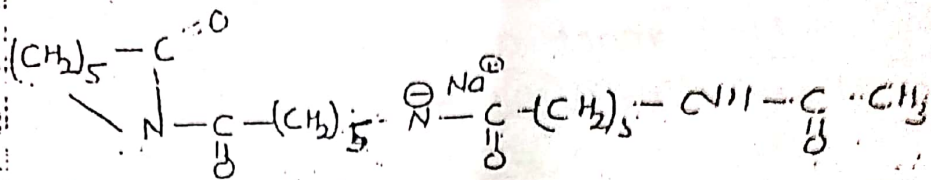
(caprolactum)



(II)  (III)

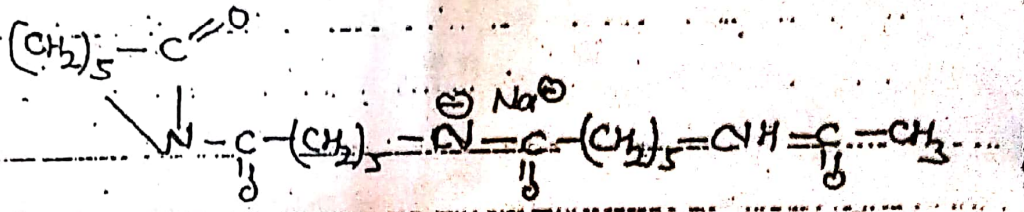
and liberates [illegible] by the [illegible] the monomeric anion].

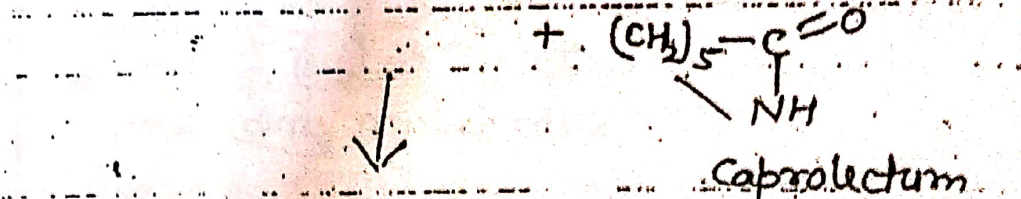
This new anion opens up the ring in the dimer (III) formed b/w the sodium caprolactum and N-acetyl caprolactum and gets it self attached, forming a trimer having again the anion (IV)



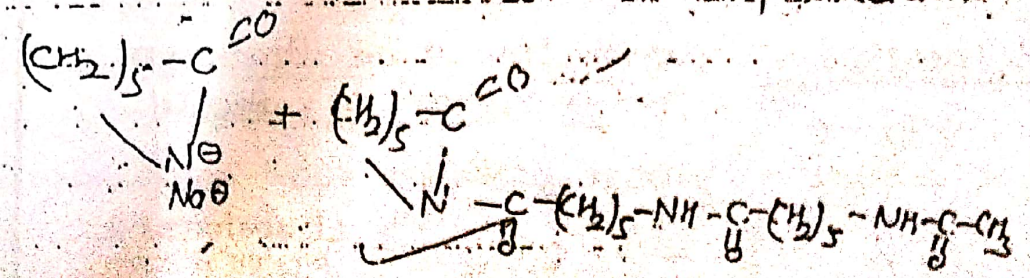
(IV)

This anion attack on caprolactum molecule and abstracts a proton and generating a new monomeric anion.





Caprolactum



and so on

(3) Termination = It occur by the proton abstraction.