

### Based on mode of polymerization:

(i) **Addition polymers:** Repeated addition of monomers containing double or triple bonds. (Polythene from ethene)

Homopolymer : Single monomeric species (Polythene)

Copolymer : Two different monomers (Buna-S, Buna-N)

(ii) **Condensation polymers:** Repeated condensation between two different bi-functional or tri-functional monomeric units. (Terylene, Nylon 6)

### Based on structure of polymers high density:

(i) Linear polymers : Long and straight. (Polythene, PVC)  $\equiv$

(ii) Branched chain polymers : Linear chains with branches (low density polythene)  $\approx$

(iii) Cross linked or network polymers: Strong covalent bond between various linear polymer chains. (Bakelite, Melamine)  $\text{---}$

### Based on source:

(i) Natural polymers: Found in plants and animals. (Proteins, rubber)

(ii) Semi-synthetic polymers: (Cellulose derivatives)

(iii) Synthetic polymers: Man-made. (Polythene, Buna-S)

### Classification

### Polymers

### Based on Molecular Forces:

(i) **Elastomers** : Rubber-like solids with elastic properties (Buna-S, Buna-N)

(ii) **Fibres** : Thread forming solids. (Nylon 6,6, Terylene)

(iii) **Thermoplastic polymers** : Linear or slightly branched long chain molecules capable of repeatedly softening on heating and hardening on cooling. (polythene, polystyrene)

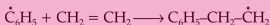
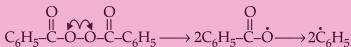
(iv) **Thermosetting polymers** : Cross linked or heavily branched molecules which on heating undergo extensive cross linking in moulds and become infusible. (Bakelite)

### Types of polymerization Reaction

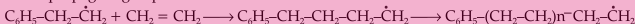
(i) **Addition/Chain Growth** : Molecules of the same/different monomers add together on a large scale.

Free radical mechanism:

(a) Chain initiation step:



(b) Chain propagating step:



(c) Chain terminating step:



(ii) **Condensation/Step Growth:** Repetitive condensation reaction between two bi-functional monomers. (Formation of terylene)

### Rubber: Types

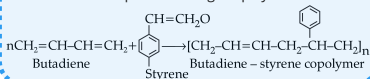
- (i) Natural rubber : natural and manufactured from rubber latex. It is a linear polymer of isoprene.
- (ii) Synthetic rubber : Any vulcanisable rubber. These are homopolymers of 1,3 butadiene derivatives.



### Molecular mass of polymers

- Expressed as an average.
- Determined by chemical and physical methods.

Copolymerization: A mixture of more than one monomeric species undergoes polymerization



### Biodegradable polymers

Contain functional groups similar to biopolymers (PHBV, Nylon 2- nylon 6)

Very large molecule having high molecular mass

Polymers

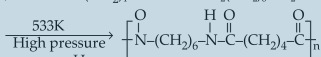
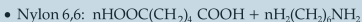
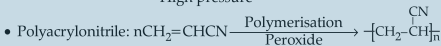
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अभ्यास ही सबसे बड़ा गुरु है।

### Preparation

#### • Polythene

Low density : Polymerization of ethene under 1000–2000 atm at 350–570 K + catalyst  
Higher density : addition polymerization of ethene in a hydrocarbon solvent at 333–343 K and 6–7 atm + catalyst



#### • Nylon 6:

