Some Important Terms

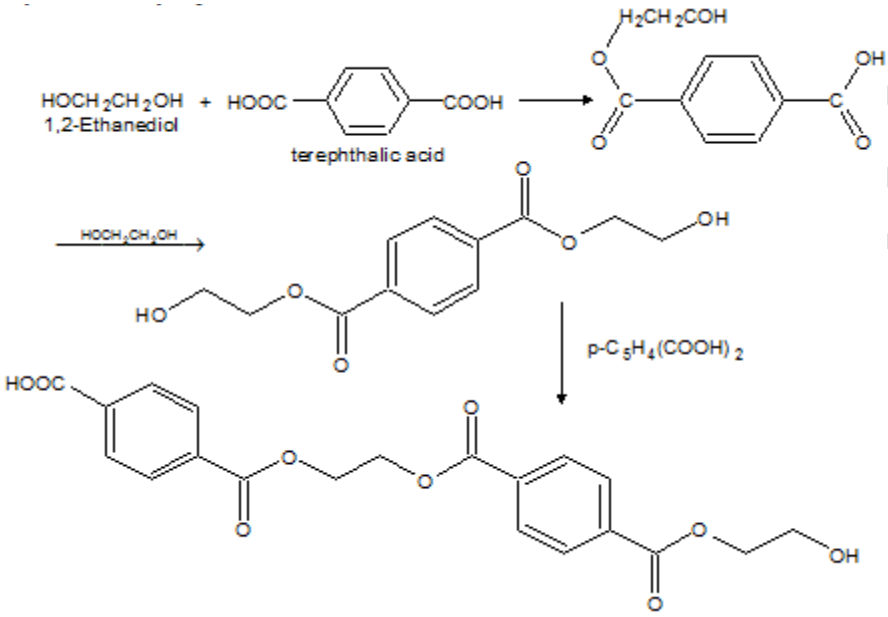
Polymer	Large molecules having high molecular mass formed by combination of number of small units called monomers.
Polymerisation	The process of formation of polymers from respective monomers.
Natural polymers	Found in plants and animals. Examples: proteins, cellulose, starch.
Synthetic polymers:	Synthesised in laboratory from natural material. Example, nylon 6, 6 , Buna-S
Addition Polymers	Formed by repeated addition of monomers having multiple bonds.
Homopolymers.	Addition polymers polymers formed from single monomeric species
Copolymers	Addition polymers formed from two different monomeric species
Condensation polymers	Formed by repeated condensation of different bi or tri-functional monomer units.
Fibres	Long thin, threadlike bits of material that are characterized by great tensile (pulling) strength in the direction of the fiber. The natural fibres – cotton, wool, silk – are typical. The lining-up is brought about by drawing – stretching — the return to random looping and coiling is overcome by strong intermolecular attractions.
Elastomers	Possesses the high degree of elasticity that is characteristic of rubber: it can be greatly deformed — stretched to eight times its original length e.g., buna N and buna S, When the stretching force is removed, the molecular chains of an elastomer do not remain extended and aligned but return to their original random conformations
Thermoplastic polymers	Soften on heating and stiffen on Cooling. e.g polythene, polystyrene, PVC
Thermosetting polymers	Do not soften on heating and cannot be remoulded. Example, bakelite

Polymers are formed in two general ways.

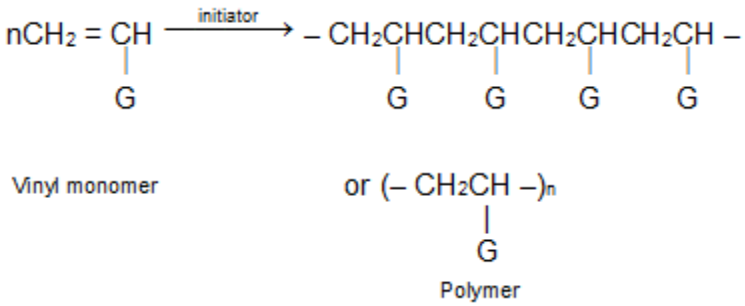
a) In chain-reaction polymerization

Rad. + $CH_2 = CH_2$ → $RadCH_2CH_2$→ $RadCH_2CH_2CH_2CH_{2\times}$ → etc.

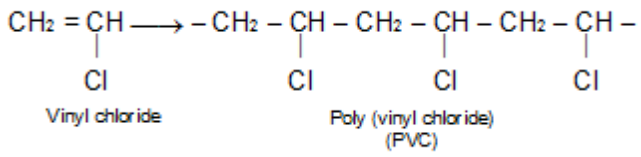
b) In step reaction polymerization,

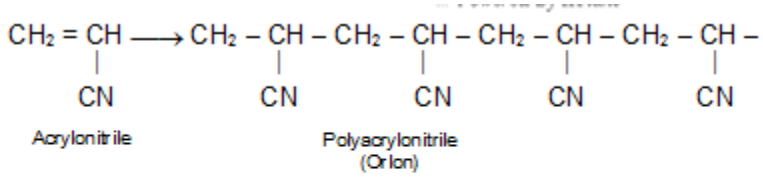


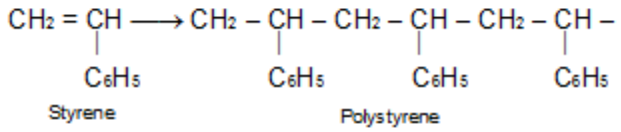
c) Free-radical vinyl polymerization:



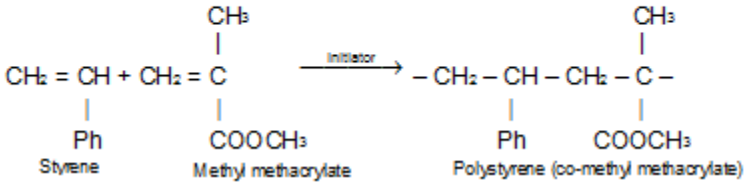
At the doubly bonded carbons — the vinyl groups — and is called *vinyl polymerization*. A wide variety of unsaturated monomers may be used, to yield polymers with different *pendant groups* (G) attached to the polymer backbone. For example.







d) Copolymerization:



Some Important Polymers:

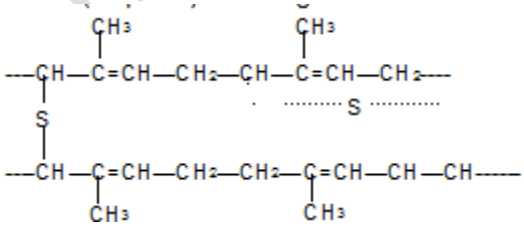
a) Natural Rubber*:*

Addition polymer of isoprene (2-methyl-1,3-butadiene)

An average chain length of 5000 monomer units of isoprene.

The rubber in which the arrangement of carbon chain is trans with respect to the double bond is known as ***Gutta Percha*** and this is the natural rubber obtained from bark of various trees.

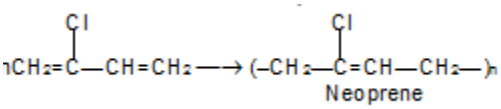
'Vulcanisation of rubber involves addition of sulphur to rubber and heating the mixture to increase the strength of natural rubber. sulphur forms short chains of sulphur atoms that link two hydrocarbon (isoprene) units together.



Vulcanised rubber is thus stronger and less sticky than the natural rubber.

b) Synthetic rubber:(Polychloroprene) or Neoprene)

It is obtained by free radical polymerisation of chloroprene in



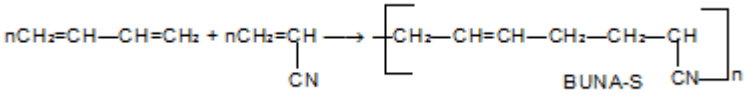
A thermoplastic and need not to be vulcanised.

It is a good general purpose rubber and superior to natural rubber as it is resistant to the reaction of aire, heat, light chemicals, alkalis and acids below 50% strength.

It is used for making transmission belts, printing rolls and flexible tubing employed for conveyence of oil and petrol.

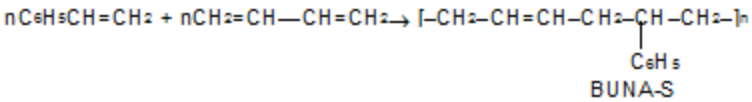
c) Buna rubbers:

i) Buna - N or GRA: it is synthetic rubber obtained by copolymerisation of one part of acryl nitrile and two parts of butadiene.



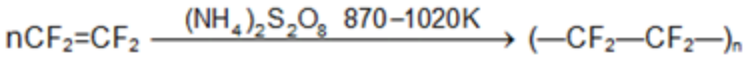
It is more rigid responds less to heat and very resistant to swelling action of petorol, oils and other organic solvents.

ii) Buna -S or GRS (General purpose Styrene rubber): It is a copolymer of three moles of butadiene and one mole of styrene and is an elastomer. It is obtained as a result of free radical copolymerisation of its monomers.



It is generally compounded with carbon black and vulcanised with sulphur. It is extremely resistant to wear and tear and finds use in manufacture of tyres and other mechanical rubber goods.

d) Teflon: It is polymer of tetrafluorethylene ($F_2C=CF_2$) which on polymerisation gives Telfon.



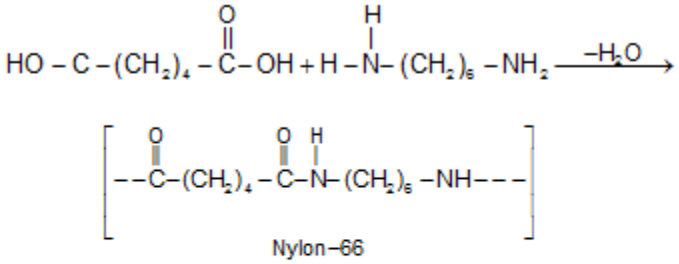
It is thermoplastic polymer with a high softening point (600K).

It is very tough and difficult to work. It is inert to most chemicals except fluorine and molten alkali metals.

It withstands high temperatures. Its electrical properties make it an ideal insulating material for high frequency installation.

e) Nylon -66:

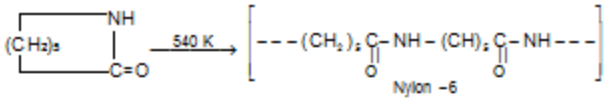
A condensation polymer formed by reaction between adipic acid and hexamethylene diamine. It is a thermoplastic polymer.



Nylon–66

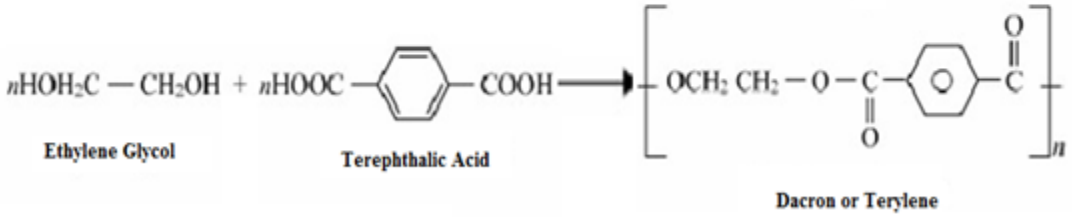
(A condensation copolymer)

f) Nylon 6 or Perolon - L: A polyamide is prepared by prolonged heating of caprolactam at 530 - 540 K.



The fiber is practically identical to Nylon in properties

g) Dacron:



Ethylene Glycol

Terephthalic Acid

Dacron or Terylene

h) Phenol-formaldehyde polymer: E.g., Bakelite Novolac