Polymers

The molecular mass of polymers varies from 103-107 u.

Rayon has a shine like silk, so also known as artificial silk.

Vulcanised rubber is also an example of semisynthetic polymers.

Due to presence of chains of varying length in a polymer sample, their molecules mass is always expressed as an average.

Bakelite due to presence of extensive crosslinking is an example of thermosetting polymer.

Monomer	*Polymer*	*Uses*
$H_2C = CH_2$ (Ethylene)	Polyethylene	Packaging, bottles, cable insulation, films and sheets
$H_2C = CHCH_2$ (Propylene)	Polypropylene	Automotive molding, carpet, rope
$H_2C = CHC_6H_5$ (Styrene)	Polystyrene (styron)	Foam and molded articles (toys), brush handles, combs, Television coil, cups, bottle caps, false roofing
$F_2C = CF_2$ (Tetrafluoroethylene)	Teflon	Values and gaskets, coatings

Both glucose and fructose show mutarotation, ie, they change their optical rotations.

The monomer of natural rubber is 2-methyl-1,3-butadiene

Polymerisation of caprolactum yields nylon-6

The additive used in the making of PVC is called Plasticiser.

Starch contains 1,4’-α-glycoside bond

Hydrolysis of sucrose gives invert sugar.

Process of formation of polymers from respective monomers is called polymerisation.

Classifications:

1) Based on the nature:

    a) Natural: plants and animal products, eg: proteins, cellulose, starch
    b) Semi-synthetic: cellulose derivatives like cellulose acetate (rayon)
    c) Synthetic: plastic (polythene), synthetic fibres-nylon 6 6

2) Structure based:

    a) Linear polymer: long and straight chains, eg: high density polythene, PVC
    b) Branched polymer: linear chains having some branches, eg: low density polythene
    c) Cross linked/network polymers: formed due to the reaction between bi and tri functional monomers. Have strong covalent bonds between various linear polymer chains, eg: Bakelite, melamine.

3) Mode of polymerisation:

    a) Addition: repeated addition of monomer molecules possessing double or triple bonds.

They are of 2 types:

i) Homopolymers: single monomeric species (constituent)
ii) Copolymers: 2 different monomeric species (constituent)

b) Condensation polymers: repeated condensation reaction between 2 bi/tri functional monomeric units.

Elimination of small molecules like water, alcohol, HCletc

Eg: terylene;nylon

4) Molecular forces:

a) Elastomers: rubber like solids with elastic properties.

Chains held together by weakest inter-molecular forces, which allow the polymer to be stretched.

Cross links introduced between chains so that polymer retracts to original position/shape

Eg: Buna-S, Buna-N

b) Fibres: thread forming solids that have high tensile strength and high modulus.

Strong intermolecular forces- Hydrogen bonding

Close packing of chains hence leading to a crystalline nature.

Eg: polyamides and polyesters

c) Thermoplastic polymers: linear/slightly branched long chain molecules.

Capable of repeatedly softening on heating and hardening on cooling.

Intermolecular forces are inbetween that of elastomers and fibres.

Eg: polythene, polystyrene, polyvinyls.

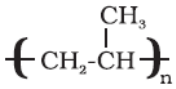
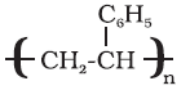
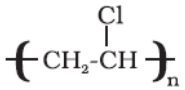
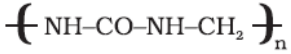
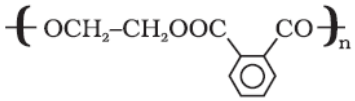
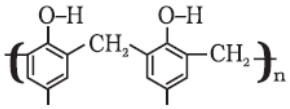
d) Thermosetting polymers: cross linked/heavily branched.

On heating undergoes extensive crosslinking in moulds and becomes infusible and can't be reused.

Eg: Bakelite

In the presence of an organic peroxide initiator, the alkenes and their derivatives undergo **addition polymerisation** or **chain growth polymerisation** through a **free radical mechanism**. Polythene, teflon, orlon, etc. are formed by addition polymerisation of an appropriate alkene or its derivative.

Condensation polymerisation reactions are shown by the interaction of bi – or poly functional monomers containing – NH_2, – OH and – COOH groups. This type of polymerisation proceeds through the elimination of certain simple molecules as H_2O, CH_3OH, etc.

Name of Polymer	Monomer	Structure	Uses
Polypropene	Propene		Manufacture of ropes, toys, pipes, fibres, etc.
Polystyrene	Styrene		As insulator, wrapping material, manufacture of toys, radio and television cabinets.
Polyvinyl chloride (PVC)	Vinyl chloride		Manufacture of rain coats, hand bags, vinyl flooring, water pipes.
Urea-formaldehyle Resin	(a) Urea (b) Formaldehyde		For making unbreak-able cups and laminated sheets.
Glyptal	(a) Ethylene glycol (b) Phthalic acid		Manufacture of paints and lacquers.
Bakelite	(a) Phenol (b) Formaldehyde		For making combs, electrical switches, handles of utensils and computer discs.