POLYMER

ADDITION POLYMERS

POLYTHENE
[ETHYLENE]
$CH_2=CH_2$

Low density polythene
- High pressure of 1000 to 2000 atm at a temperature of 350K to 570 K
- Presence of traces of dioxygen or a peroxide initiator
- Highly branched structure
- Chemically inert & tough but flexible Poor conductor of electricity
- Used in the insulation of electricity carrying wires and manufacture of squeeze bottles, toys & flexible pipes

High density polythene
- Low pressure of 6-7 atm and a temperature of 333 K to 343 K
- Presence of a catalyst such as triethylaluminium and titanium tetrachloride (Ziegler-Natta catalyst
- Linear polymers
- Chemically inert and more tough and hard
- Used in the manufacturing buckets, dustbins, bottles, pipes, etc

POLYPROPYLENE
[PROPYLENE]
$CH_2=CHCH_3$
Ropes, Toys, Pipes, Fibres, etc.

POLY VINYL CHLORIDE (PVC)
[VINYL CHLORIDE]
$CH_2=CHCl$
Rain coats, Hand bags, Vinyl flooring

POLY STYRENE
[STYRENE]
$CH_2=CHC_6H_5$
Insulator, wrapping material,

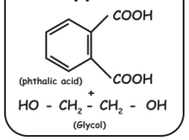
POLY ACRYLONITRILE
[PAN, ORLON, ACRILAN]
[ACRYLONITRILE]
$CH_2=CH-CN$
blankets, clothing

POLY TETRAFLUORO ETHYLENE (TEFLON)
[TETRAFLUORO ETHYLENE]
$CF_2=CF_2$
Non-stick surface coated utensils

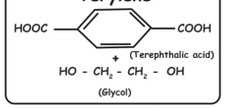
POLY METHYL METHACRYLATE
[PMMA, Lucite, Plexiglas]
[METHYL METHACRYLATE]
$CH_2=C(CH_3)\,CO_2CH_3$

CONDENSATION POLYMERISATION

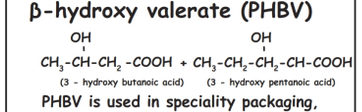
POLYESTERS

Glyptal


Paints & Lacquers

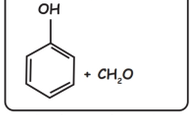
Dacron or Terylene


Crease resistant, used in blending with cotton & wool fibres, glass reinforcing materials in safety helmets, etc

Poly β-hydroxybutyrate-co-β-hydroxy valerate (PHBV)


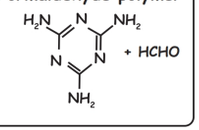
PHBV is used in speciality packaging, orthopaedic devices and in controlled release of drugs

RESINS

Phenol - Formaldehyde polymer


Novolac used in paints

- Novolac on heating with formaldehyde undergoes cross linking to form an infusible solid mass called bakelite
- Electrical switches and handles of various utensils

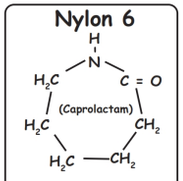
Melamine - Formaldehyde polymer


Manufacture of unbreakable crockery

Urea-Formaldehyde polymer
$NH_2-CO-NH_2 + HCHO$
For making unbreakable cups & laminated sheets

POLYAMIDES

Nylon 6,6
$nHOOC(CH_2)_4COOH + n\,H_2N\,(CH_2)_6\,NH_2$
(Adipic acid) (Hexa methylene diamine)
Making sheets, bristles for brushes & in textile industry.

Nylon 6


Manufacture of tyre cords, fabrics and ropes

Nylon 2 - Nylon 6
$H_2N - CH_2 - COOH$ (Glycine) + $H_2N - (CH_2)_5 - COOH$ (Amino caproic acid)

CLASSIFICATION OF POLYMERS

Based on molecular forces
- Elastomers: Rubber like solids with elastic property eg: Buna-S, Buna-N, Neoprene
- Fibres: High tensile strength & high modules eg: Polyamides (nylon-6,6) Polyesters (terylene)
- Thermoplastic polymers: Intermediate b/w elastomer & fibres Capable of repeat softening on heating & hardening on cooling eg: Polythene, polystyrene, polyvinyl etc.
- Thermosetting polymers: Crosslinked & heavily branched polymers. These cannot be reused eg: Bakelite, resins, urea-formaldehyde etc.

Based on structure
- Linear eg: high density polythene, poly vinyl chloride
- Branched eg: low density polythene
- Cross-linked eg: Bakelite, melamine - formaldehyde resin

Based on source
- Natural polymers eg: protein, cellulose, starch, resins, rubber
- Semi-Synthetic polymers eg: Cellulose acetate (rayon), cellulose nitrate etc.
- Synthetic polymers eg: Nylon-6, 6, Buna-S

Based on mode of polymerisation
- Addition polymers
- Condensation polymers Eg: Nylon 6,6

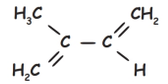
Types of Polymerisation Reactions
- Addition Polymerisation or Chain Growth Polymerisation
- Condensation Polymerisation or Step Growth Polymerisation

RUBBER

1. NATURAL RUBBER

1.Natural rubber

(Isoprene) (2-methyl-1, 3-butadiene)



Vulcanisation of rubber:

Heating a mixture of raw rubber with sulphur and an appropriate additive at a temperature range between 373K to 415 K.

2. SYNTHETIC RUBBER

Neoprene

(Chloroprene) (2-Chloro-1, 3-butadiene)

$CH_2 = \underset{Cl}{C} - CH = CH_2$

Manufacturing of conveyor belts, gaskets & hoses

Buna - N

1,3-Butadiene+Acrylonitrile

$CH_2 = CH - CH = CH_2 + CH_2 = \underset{CN}{CH}$

Making of oil seals, tank lining, etc

Buna - S

1, 3 - Butadiene + Styrene

$CH_2=CH-CH=CH_2+C_6H_5CH=CH_2$

Auto tyres, floor tiles, foot wear, cable insulation