UNIT 15

POLYMERS

Polymers in Greek means, poly means many and mer means unit or part. Polymers means many units or parts.

1. What are polymers? 1M

A large number of simple repeating units linked together through covalent bond are called polymers. They are also called as macromolecules

2. What is a monomer? 1M

The simple molecule which combine to form polymer are called monomers.

3. What is polymerisation ? 1M

The process by which monomers are converted into polymer is called polymerisation.

Classification of polymers:

Classification based on Source:

4. What are natural polymers? Give example. 2 M

The polymers which are found in nature i.e in plants and animals are called natural polymers.

Ex: proteins, Nucleic acid , starch, cellulose, rubber

5. What are semi synthetic polymers? Give examples. 2M

Chemically modified natural polymers are called semi synthetic polymers.

Ex: Cellulose acetate (rayon), cellulose nitrate, valcanised rubber.

6. What are synthetic polymers? Give examples. 2M

Synthetic polymers are man –made polymers synthesized in the Laboratories or industries used in daily life.

Ex: Polythene, poly vinyl chloride, nylon, terylene, Teflon bakelite

Classification based on structure of polymer:

7. What is Linear polymer? Give example.

In Linear polymer, the monomer units are linked together to form Long straight chains of polymer molecule

Ex: polythene, p v c, nylon, polyester, poly styrene

8. What is branched chain polymer? Give example

In branched chain polymer, the monomer unit combines to produce the Linear chains having some branches.

Ex: Low density poly then, starch, glycogen etc.

9. What are cross linked or network polymer ? Give examples.

Cross- linked polymers are formed from monomer units containing two or more functional Group. They contain strong covalent bond between various linear polymer chains.

Ex: Bakelite, melamine, urea –formaldehyde etc.

Classification based on mode of polymerization

10. What is addition polymerization? Give examples

A polymer formed by the addition of repeating monomer units possessing double or triple bond without elimination of by product molecule during polymerization is called addition polymer.

Ex: polythene , poly propene

Low density polyethene (LDPE)	$n(CH_2=CH_2) \xrightarrow[\text{peroxide or } O_2]{\text{2000 atm, 200°C}} -(CH_2-CH_2)_n-$	Electrical insulator, toys, squeeze bottles
HDPE (high density polyethene)	$n(CH_2=CH_2) \xrightarrow[TiCl_4\text{-}Al(C_2H_5)_3\text{,6 atm, 60°C}]{\text{Ziegler-Natta catalyst}} -(CH_2-CH_2)_n-$	Buckets, dustbin, pipes
Teflon (polytetra fluroethene)	$nCF_2 = CF_2 \xrightarrow[\text{initiator}]{\text{free radical}} -(CF_2-CF_2)_n-$	Non-stick cookware, oil seals, gaskets
Polyacrylonitrile (orlon)	$nCH_2=\underset{\underset{\text{acrylonitrile}}{\text{CN}}}{\underset{\mid}{CH}} \xrightarrow[\text{catalyst}]{\text{peroxide}} \left[-CH_2-\underset{\underset{\text{CN}}{\mid}}{CH}-\right]_n$	Substitute for wool

(Any one example)

11. What are homo polymer? Give example

Addition polymers formed by the polymerization of one type of monomers are called homo polymer

Ex: Polythene (monomer unit in ethene)

12. What are co polymers? Give on example

Addition polymers formed by the polymerization of two different monomer units are called co-polymer.

Ex: Buna-S, Buna-N, Nylon 6,6 etc.

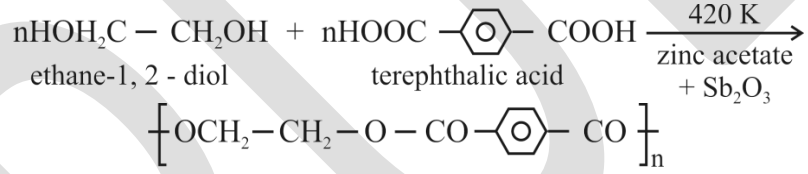
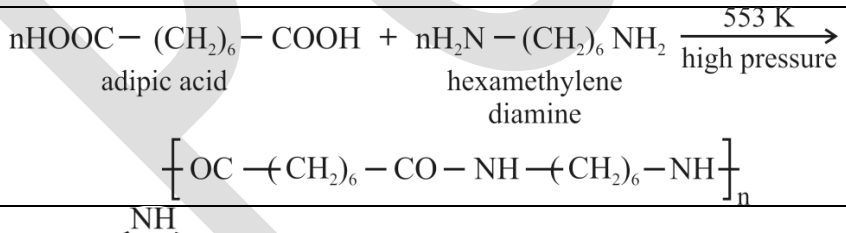
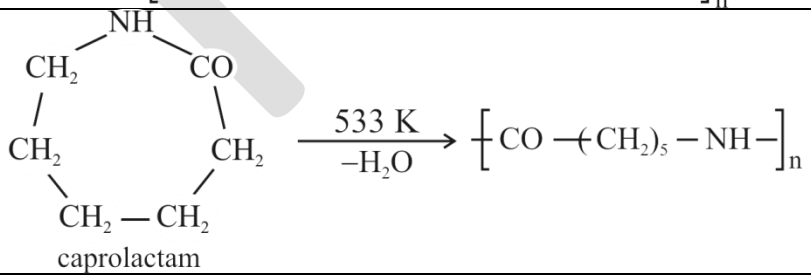
13. What is Co- polymerization

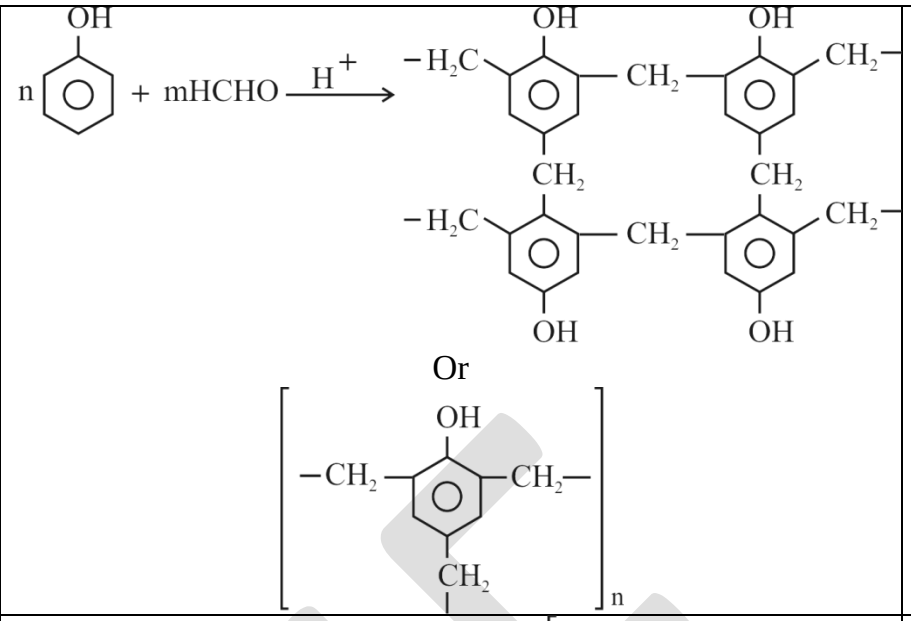
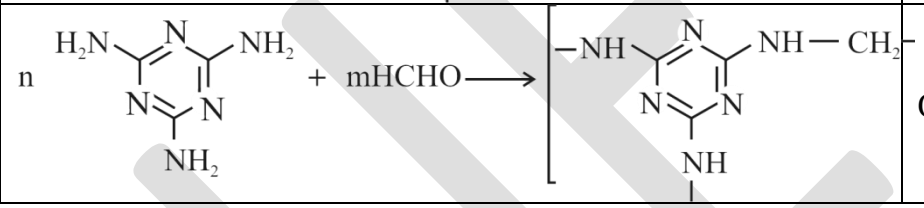
It is polymerization reaction in which a mixture of more than one monomeric species is allowed to polymerize and form a co polymer.

14. What is condensation polymerization? Give examples

A polymer formed by the condensation of two different bifunctional or trifunctional monomers with the elimination of simple molecules like water, methanol ammonia is called condensation polymerization.

Ex: Nylon 6,6

Polymer	polymerization	uses
Terylene/ Dacron (a polyester		Terywool, terycot fabrics, safety glass
Nylon 6, 6 (a polyamide)		Textiles, bristles for brushes
Nylon-6		Tyre cords, fabrics, ropes

Bakelite (phenol formaldehyde)	 Or	Combs, handles of utensils, electrical switches
Melamine formaldehyde		Crockery

Classification based on molecular forces:

15. What are elastomers? Give examples

Elastomers are rubber like solid with elastic properties. In these the polymer chains are held by weakest intermolecular forces. The weak binding forces permit the polymer to be stretched.

Ex: vulcanized rubber, Buna-S, Buna-N, neoprene etc.

16. What are fibers? Give examples

Fibres are thread- like polymer possessing high tensile strength and high modulus. These characterization are due to strong intermolecular forces like hydrogen bonding which result in close packing of chain impart crystalline structure to the polymer.

Ex: Nylon 6, 6, terylene, Nylon 6, silk etc

17. What is thermoplastic polymer? Give example

Thermoplastic are linear or slightly branched polymers which can be repeatedly softened on heating and hardened on cooling.

Ex: polythene, polypropene , pvc, polystyrene, Teflon etc.

18. What are thermosetting polymers? Give Examples

Thermosetting polymers are cross linked and heavily branched molecules. On heating they undergo extensive cross linking and become hard and infusible. These cannot be reused.

Ex: Bakelite, urea formaldehyde resin, etc.

19. Name the monomer and write the partial structure of polythene?

Monomer of polythene - Ethene or Ethylene

Partial structure - $-(CH_2-CH_2)_n-$

20. Name the monomer and write the partial structure of Nylon-6 ?

Monomer of Nylon-6 - caprolactum

Partial structure - $[-CO-(CH_2)_5-NH-]_n$

21. Name the monomers and write the partial structure of Nylon- 6,6

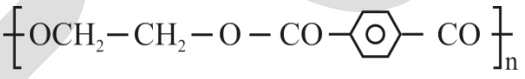
Monomer of Nylon-6,6 - Hexamethylene diamine and Adipic-acid

Partial structure - $[-OC-(CH_2)_4-CONH-(CH_2)_6-NH-]_n$

22. Name the monomers and write the partial structure of terylene (Dacron)

Monomer of terylene - Ethylene glycol and terephthatic-acid

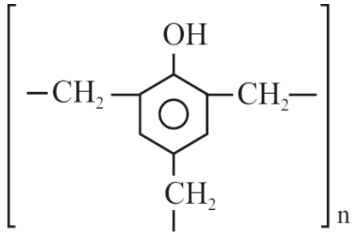
Partial structure -



23. Name the monomer and write the partial structure of Bakalite ?

Monomer of Bakalite - Phenol and formaldehyde

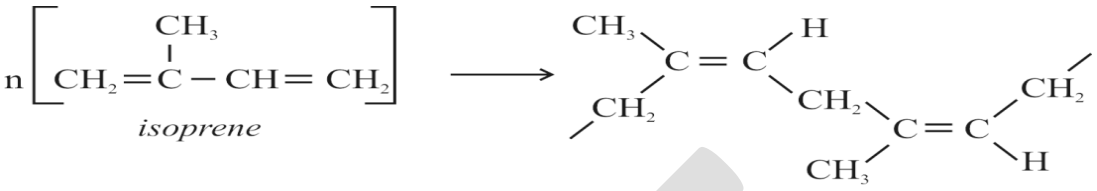
Partial structure -



RUBBER:

24. Name the monomer present in natural rubber.Write the partial structure

Natural rubber is a polymer of cis-2-methyl-1,3-butadiene (isoprene). (cis-poly-isoprene). Its partial structure is



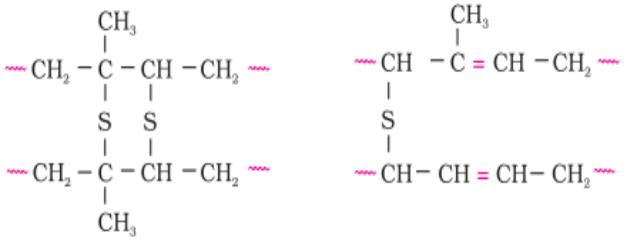
25. Define Synthetic rubber? Give one example

Synthetic rubber is defined as any valcanisable rubber like polymer capable of getting stretched to twice its length and returns to its original length, size and shape when the stretching force is withdrawn

Ex: Neoprene, Buna-S, Buna-N

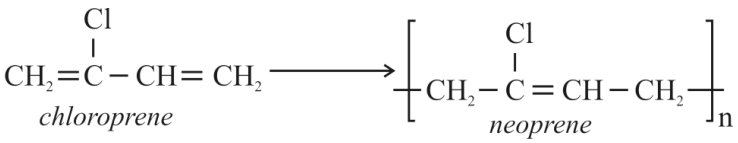
26. What is Valcanisation ?

The process of heating natural rubber with sulphur or sulphur containing compounds at about 415k for a few hours in order to give strength and elasticity to natural rubber is called valcanisation.



27. Explain the preparation of Neoprene? Write the equation.

When chloroprene (2-chloro-1,3-butadiene) is heated in the presence of peroxide catalyst, polychloroprene or neoprene is formed



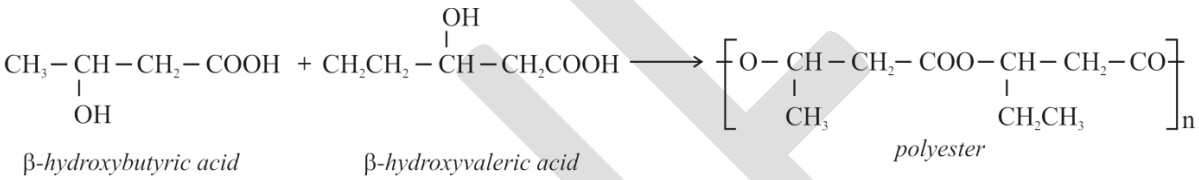
28. Explain the preparation of Buna-N?

When 1,3-butadiene and acrylonitrile are heated in the presence of peroxide catalyst, Buna-N is formed

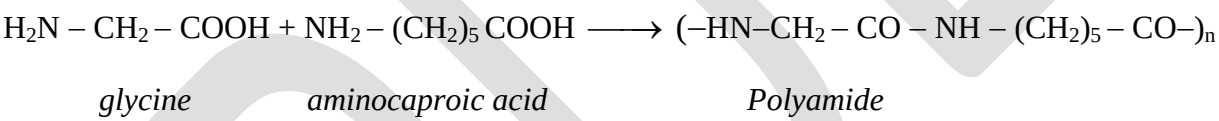
29. What is bio-degradable polymer? Give example

Bio-degradable polymer are those which contain functional groups similar to the functional groups present in bio-polymers

Ex: 1. Polyhydroxybutyrate-co-hydroxyvalerate (PHBV)



2. Nylon-2-Nylon-6



30. What is non bio-degradable polymer? Give example

A large number of synthetic polymers are resistant to the environmental degradation processes and responsible for the accumulation of polymers solid waste materials and cause environmental problems are called Non-biodegradable polymers.

Ex: polythene, Nylon, terylene etc