

Unit - 15

POLYMERS

Points to Remember

1. Polymers are defined as high molecular mass macromolecules which consist of repeating structural units derived from the appropriate monomers.
2. In 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.
3. Condensation polymerisation reactions are shown by the addition 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 such as H_2O , NH_3 etc.
4. Formaldehyde reacts with phenol and melamine to form the corresponding condensation polymer products. The condensation polymerisation progresses through step by step and is called also step growth polymerisation.
5. Nylon, bakelite and dacron are some of the important examples of condensation polymers.
6. A condensation of two different unsaturated monomers exhibits copolymerisation. A copolymer like Buna-S contains multiple units of 1, 3-Butadiene and styrene.
7. Natural rubber is cis-1, 4-polyisoprene. It can be made more tough by the process of vulcanization with sulphur.
8. Synthetic rubbers like Buna-N are usually obtained by copolymerisation of alkene and 1, 3-Butadiene derivatives.
9. In view of potential environmental hazards of synthetic polymeric wastes, certain biodegradable polymers such as PHBV and Nylon-2-Nylon-6 are developed as alternatives.

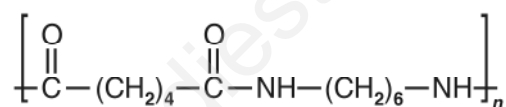
QUESTIONS

VSA TYPE QUESTIONS (1 - MARK QUESTIONS)

1. Define the term copolymer.
2. Identify homopolymer from the following examples Nylon-66, Nylon-6, Nylon- 2-Nylon-6.
3. Give example of a natural polyamide which is an important constituent of diet.

[Hint : Proteins]

4. Classify polythene and bakelite as thermosetting plastics or thermoplastics.
5. Among fibres, elastomers and thermosetting polymers, which one has strongest intermolecular forces of attraction?
6. Why is bakelite called a thermosetting polymer.
7. Give the monomers of bakelite.
8. Identify the monomer in the following polymeric structure.

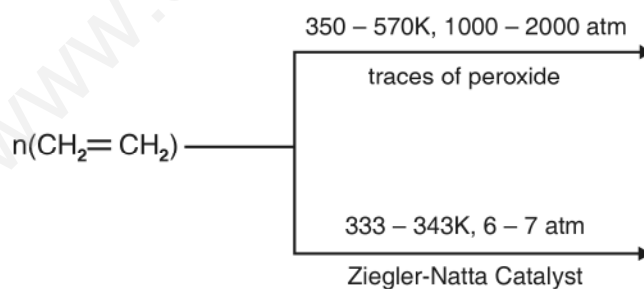


9. Nylon-2-Nylon-6 is a biodegradable polymer obtained from glycine, $\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$ and aminocaproic acid, $\text{H}_2\text{N}-(\text{CH}_2)_5-\text{COOH}$. Write the structure of this polymer.
10. Give two uses of teflon.
11. Name the polymer used for making insulation material for coating copper wire. [Hint : PVC].
12. Write the name and structure of monomer of the polymer which is used as synthetic wool.
13. How is vulcanized rubber obtained?
14. Name the polymer used for making radio television cabinets and feeding bottles of children.
15. What do the digits 6 and 66 represent in the names nylon-6 and nylon-66?
16. Write the full form of PHBV.

17. Which of the following sets has all polymers capable of repeatedly softening on heating and hardening on cooling?
- Glyptal, Melamine, PAN.
 - PVC, Polystyrene, polythene.
 - Polypropylene, urea formaldehyde resin, teflon.
- *18. Why benzoyl peroxide is used as an initiator for chain growth polymerisation?
[Hint : It easily generates free radicals required for initiation of reaction.]

SA (I) TYPE QUESTIONS (2 - MARK QUESTIONS)

- Give the structure of monomer of neoprene. What is the advantage of neoprene over the natural rubber?
- Classify the following as homopolymer or copolymer. Also classify them as addition or condensation polymers.
 - $-(\text{NH}-\text{CH}(\text{R})-\text{CO})_n-$
 - $-(\text{CH}_2-\text{CH}=\text{CH}-\text{CH}_2-\underset{\text{C}_2\text{H}_5}{\text{CH}}-\text{CH}_2)_n$
- Give the mechanism of polymerisation of ethene to polythene in presence of benzoyl peroxide.
- Complete the following reactions :

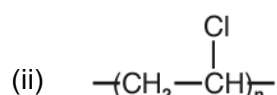
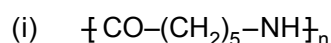


- What is the difference between step growth polymer and chain growth polymer?
 - Give one example of each type.

6. How can you differentiate between thermosetting and thermoplastic polymers.
7. Mention the type of intermolecular forces present in nylon-66. What properties do they impart to nylon?

[Hint : Strong intermolecular forces of attraction like Hydrogen bonding. This results in close packing of chains and thus impart crystalline nature to the fibres.]

8. What is the difference between linear chain and branched chain polymers. Explain giving examples.
9. Identify the polymer whose structure are given and mention one of their important use.



10. Arrange the following polymers in the order of increasing intermolecular forces :
 - (i) Nylon-6,6, Buna-S, Polythene.
 - (ii) Nylon-6, Neoprene, Polyvinylchloride
11. Write the expanded form and give the structures of monomers for the following polymers:
 - (i) PAN
 - (ii) PTFE
12. Novolac is the linear polymer which on heating with formaldehyde forms cross-linked bakelite. Write the structures of monomers and the polymer novolac.
13. Write the structure of following polymers and also give their main uses :
 - (a) Polystyrene
 - (ii) Melamine - formaldehyde resin.
14. Identify the polymers used in the manufacture of paints and lacquers. Write the structure of the polymer and its monomers.
15. Can a copolymer be formed by both addition and condensation polymerisation? Explain with the help of examples.

