

## UNIT 14


## Polymers

1. **Polymer** : It is a very large molecule having molecular mass  $10^3$ - $10^7$  g mol<sup>-1</sup>. They are formed by joining together repeating structural units, called monomers.
2. **Classification of Polymers** :
  - (a) **Based on Source** :
    - (i) **Natural** : Found in plants and animals, e.g., Proteins, cellulose, natural rubber, silk, wool.
    - (ii) **Synthetic** : Man-made, e.g., Nylon, polyester, neoprene, bakelite, teflon, PVC, polystyrene.
    - (iii) **Semisynthetic** : Natural but modified by man e.g. cellulose nitrate.
  - (b) **Based on Structure** :
    - (i) **Linear polymers** : This consist of long and straight chain repeating units, e.g., Polythene (HDPE), PVC, nylon, polyester.
    - (ii) **Branched polymers** : This contain linear chains having some branches, e.g., amylopectin, glycogen etc.
    - (iii) **Cross-linked polymers** : Strong covalent bonds are present between various linear polymer chains, e.g., Bakelite, urea-formaldehyde polymer, melamine, formaldehyde polymer etc.
  - (c) **Based on mode of polymerization** :
    - (i) **Addition polymers** : These are formed by the repeated addition of monomer molecules possessing multiple bonds, e.g., polythene, polypropene, polystyrene, PMMA (polymethyl metha crylate).
    - (ii) **Condensation polymers** : These are formed by the repeated condensation reaction of different bifunctional or trifunctional monomers with the elimination of small molecules like water, HCl, NH<sub>3</sub>, alcohol, etc., e.g., Bakelite, nylon, polyester, urea-formaldehyde resin.
  - (d) **Based on molecular forces** :
    - (i) **Elastomers** : Forces of interaction between polymer chains is weakest, e.g., natural rubber, neoprene, vulcanized rubber.

- (ii) **Fibers** : Strong hydrogen bonds are present between the polymer chains. They have high tensile strength, e.g., Nylon, polyester, silk, wool, orlon, rayon etc.
- (iii) **Thermoplastics** : They are linear/slightly branched chains molecules capable of repeated softening on heating and hardening on cooling, e.g., Polythene, PVC, polystyrene, polypropene.
- (iv) **Thermosetting plastics** : They are cross-linked or heavily branched molecules, which on heating undergo extensive cross-linkages and become infusible, e.g., Bakelite, urea-formaldehyde resin.
- (e) **Based on growth of polymerization** : Depending upon the mechanism of polymerization, polymers are classified as :
- (i) **Addition polymers or Chain growth polymers** : They follow mostly free radical mechanism.
- (ii) **Condensation polymers or Step growth polymers** : Because they are formed in gradual steps.

### Polymers and Their Monomers

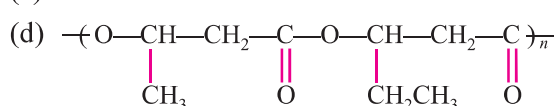
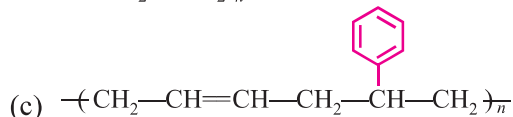
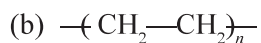
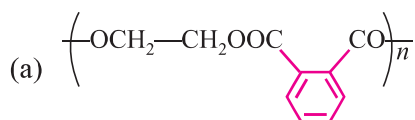
S. No.	Name of Polymer	Structure	Monomer	Uses
1.	Polythene	$(-\text{CH}_2-\text{CH}_2-)_n$	$\text{CH}_2=\text{CH}_2$	As insulator, anticorrosive, packing material, household and laboratory wares.
2.	Polystyrene	$\left( \begin{array}{c} \text{CH} - \text{CH}_2 \\   \\ \text{C}_6\text{H}_5 \end{array} \right)_n$ Poly Styrene	$\begin{array}{c} \text{CH} = \text{CH}_2 \\   \\ \text{C}_6\text{H}_5 \end{array}$ Styrene	As insulator, wrapping material, manufacture of toys and household articles.
3.	Polyvinylchloride (PVC)	$\begin{array}{c} \text{Cl} \\   \\ (-\text{CH}_2-\text{CH}-)_n \end{array}$	$\text{CH}_2 = \text{CHCl}$ Vinyl chloride	In manufacture of raincoats, hand bags, vinyl flooring and leather clothes.
4.	Polytetrafluoroethylene (PTFE) or Teflon	$(-\text{CF}_2-\text{CF}_2-)_n$	$\text{CF}_2 = \text{CF}_2$ TFE	As lubricant, insulator and making cooking wares.
5.	NOVOLAC	$\left( \begin{array}{c} \text{OH} \quad \text{OH} \\   \quad   \\ \text{C}_6\text{H}_4 - \text{CH}_2 - \text{C}_6\text{H}_4 - \text{CH}_2 \end{array} \right)_n$	(a) HCHO (b) $\text{C}_6\text{H}_5\text{OH}$	In making bonding give varnishes, lacquers etc.
6.	Polyacrylonitrile (Orion) (Acrilan)	$\begin{array}{c} \text{CN} \\   \\ (-\text{CH}_2-\text{CH}-)_n \end{array}$	$\text{CH}_2 = \text{CHCN}$ Acrylonitrile	In making synthetic fibres and synthetic wool.
7.	Styrene butadiene rubber (SBR or Buna-S)	$(-\text{CH}_2-\text{CH}(\text{C}_6\text{H}_5)-\text{CH}=\text{CH}-\text{CH}_2-)_n$	(a) $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$ (b) $\begin{array}{c} \text{CH} = \text{CH}_2 \\   \\ \text{C}_6\text{H}_5 \end{array}$	In making automobile tyres and footwear.

8.	Nitrile rubber (Buna-N)	$(-\text{CH}_2-\text{CH}(\text{CN})-\text{CH}_2-\text{CH}(\text{CN})-\text{CH}_2-)_n$	(a) $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$ (b) $\begin{array}{c} \text{CH} = \text{CH}_2 \\   \\ \text{CN} \end{array}$	In making oil seals, manufacture of hoses and tank linings.
9.	Neoprene	$(-\text{CH}_2 - \text{C}(\text{Cl}) = \text{CH} - \text{CH}_2 -)_n$	$\text{CH}_2 = \underset{\text{Cl}}{\text{C}} - \text{CH} = \text{CH}_2$ Chloroprene	As insulator, making conveyor belts and printing rollers.
10.	Natural rubber (NR)	$\left( \begin{array}{c} \text{CH}_2 \\ \diagdown \\ \text{C} = \text{C} \\ \diagup \\ \text{CH}_2 \end{array} \begin{array}{c} \text{CH}_2 \\ \diagdown \\ \text{H} \\ \diagup \\ \text{CH}_3 \end{array} \right)_n$ is form	$\text{CH}_2 = \underset{\text{CH}_3}{\text{C}} - \text{CH} = \text{CH}_2$ Isoprene	In making erasers, tyres, tubes, vulcanised rubber etc.
11.	Terylene (Dacron)	$(-\text{O}-\text{CH}_2-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}{\text{C}}-)_n$	(a) $\text{HOOC} - \text{C}_6\text{H}_4 - \text{COOH}$ (b) $\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$	For making fibres, safety belts, tyre cords, tents etc.
12.	Polypropene = P Propene	$(-\text{CH}_2-\underset{\text{CH}_3}{\text{CH}}-)_n$	Propene $\text{CH}_3 - \text{CH} = \text{CH}_2$	Ropes, toys, pipes, fibre etc. strings.
13.	Glyptal	$(-\text{OCH}_2-\text{CH}_2\text{OOC}-\text{C}_6\text{H}_4-\text{COO}-)_n$	$\text{HOOC}-\text{C}_6\text{H}_4-\text{COOH}$ $\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$	As binding material in preparation of mixed plastics and plants.
14.	Nylon 6	$(\text{NH}-[\text{CH}_2]_5-\overset{\text{O}}{\parallel}{\text{C}}-)_n$	 Caprolactum	In making fibres, plastics, tyre cords and ropes.
15.	Nylon 66	$(-\text{NH}-(\text{CH}_2)_4-\overset{\text{O}}{\parallel}{\text{N}}-\text{C}(\text{O})-(\text{CH}_2)_4-\overset{\text{O}}{\parallel}{\text{C}}-)_n$	(a) $\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$ (b) $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$	In making brushes, synthetic fibres, parachutes, ropes and carpets.
16.	Bakelite	$\left( \begin{array}{c} \text{OH} \quad \text{OH} \\   \quad   \\ \text{C}_6\text{H}_4 - \text{CH}_2 - \text{C}_6\text{H}_4 - \text{CH}_2 - \end{array} \right)_n$	(a) HCHO (b) $\text{C}_6\text{H}_5\text{OH}$	For making gears, protective coating and electrical fittings.
17.	Urea formaldehyde resin	$(-\text{NH}-\text{CO}-\text{NH}-\text{CH}_2-)_n$	(a) HCHO (b) $\text{NH}_2\text{CONH}_2$	For making unbreakable cups and laminated sheets.
18.	Melamine formaldehyde resin	$\left( \begin{array}{c} \text{NH} \quad \text{N} \quad \text{NH}-\text{CH}_2- \\ \diagdown \quad \diagup \\ \text{N} \quad \text{N} \\ \diagup \quad \diagdown \\ \text{NH}_2 \end{array} \right)_n$	(a) $\text{H}_2\text{N}-\text{N}(\text{NH}_2)-\text{NH}_2$ (b) HCHO	In making plastic crockery, unbreakable cups and plates.
19.	Poly- $\beta$ -hydroxy butyrate-co- $\beta$ -hydroxy valerate [PHBV]	$(-\text{O}-\underset{\text{R}}{\text{CH}}-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-)_n$ $\text{R} = \text{CH}_3\text{C}_2\text{H}_5$	$\text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_2 - \text{COOH}$ $\text{CH}_3 - \text{CH}_2 - \underset{\text{OH}}{\text{CH}} - \text{CH}_2 - \text{COOH}$	As packaging, orthopaedic devices and in controlled drug release.

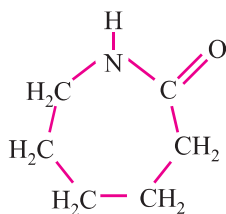
**MULTIPLE CHOICE QUESTIONS**

- 1. An example of biopolymer is :**  
(a) Teflon (b) Rubber  
(c) Nylon-66 (d) DNA
- 2. Which of the following polymer do not involve cross linkage?**  
(a) Melamine (b) Bakelite  
(c) Polythene (d) Vulcanised rubber
- 3. Polymer obtained by condensation polymerisation is:**  
(a) Polythene (b) Teflon  
(c) Phenol-formaldehyde (d) Nitrite rubber
- 4. Which is an example of thermosetting plastic?**  
(a) Polythene (b) PVC  
(c) Neophene (d) Bakelite
- 5. Natural rubber is a polymer of:**  
(a) Butadiene (b) Ethyne  
(c) Styrene (d) Poly isophene
- 6. Terylene is a condensation product of ethylene glycol and**  
(a) Benzoic acid (b) Pnthalic acid  
(c) Salicylic acid (d) Terephthalic acid
- 7. The process involving heating of natural rubber with sulphur is known as:**  
(a) vulcanisation (b) galvanisation  
(c) sulphonation (d) Bessemerisation
- 8. The interparticle forces present in Nylon-66 are:**  
(a) Vauder wall's forces  
(b) Hydrogen bonding  
(c) Dipole dipole interactions  
(d) None of these
- 9. Which of the following polymers of glucose is stored by animals?**  
(a) Cellulose (b) Anylose  
(c) Amylopectin (d) G-lycogen
- 10. The commercial name of polyacrylonitrile is .....**  
(a) Dacron (b) Orlon (acrilaw)  
(c) PVC (d) Bakelite

11. In which of the following polymers ethylene glycol is one of the monomer units?



12. Which of the following polymer can be formed by using the following monomer unit?



(a) Nylon 6, 6

(b) Nylon 2-nylon6

(c) Melamine polymer

(d) Nylon-6

13. Which of the following all characteristics of thermosetting polymers?

(a) Heavily branched cross linked polymers

(b) I inrar slightly branched long chain molecule

(c) Become infusible on moulding so cannot be reused.

(d) Soften on heating and harden on cooling, can be reused.

14. Which of the following monomers form biodegradable polymers?

(a) 3-hydroxybutanoic acid + 3 – hydroxypentanoic acid

(b) G-lycins + amino caproic acid

(c) Ethylene glycol + phthalic acid

(d) Capulactum

15. Which of the following polymers can have strog intermolecular forces.

(a) Nylon

(b) Polystyrene

(c) Rubber

(d) Polyesters

**Matching Column Type**

**16. Match the polymers given in Column-I with their commercial names given in column-II.**

- |   |              |
|---|--------------|
| (i) polyester of glycol and phthalic acid         | (a) Novolac  |
| (ii) Copolymer of 1, 3-butadiene                  | (b) G-lyptal |
| (iii) Phenol and formaldehyde                     | (c) Buna-S   |
| (iv) Polyester of glycol and terephthalic acid    | (d) Bura-N   |
| (v) Copolymer of 1, 3-butadiene and acrylonitrile | (e) Dacron   |

**17. Match the polymers given in column-I with the type of linkage present in them given in column-II.**

- |                 |                            |
|-----------------|----------------------------|
| (i) Terylene    | (a) Glycosidic linkage     |
| (ii) Nylon      | (b) Ester linkage          |
| (iii) Cellulose | (c) Phosphodiester linkage |
| (iv) Protein    | (d) Amide linkage          |
| (v) RNA         |                            |

**Assertion and Reason Type**

**Note :** In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- Assertion and reason both are correct statement but reason does not explain assertion.
- Assertion and reason both are correct statements and reason explains the assertion.
- Both assertion and reason are wrong statement.
- Assertion is correct statement and reason is wrong statement.
- Assertion is wrong statement and reason is correct statement.

**18. Assertion :** Polyamides are best used as fiber because of high tensile strength.

**Reason :** Strong intermolecular forces (like hydrogen bonding within polyamides) lead to close packing of chains and increase the crystalline character, hence, provide high tensile strength to polymers.

**19. Assertion :** Network polymers are thermosetting.

**Reason :** Network polymer have high molecular mass.

**Integer Type Question**

**20. The number of thermoplastic polymers among teflon, polythene, PVC, polystyrene, bakelite, nylon 6, Melamine formaldehyde, PMMA, are:**

0	1	2	3	4	5	6	7	8	9
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## ANSWERS

1. (c) 2. (c) 3. (d) 4. (d) 5. (a) 6. (a) 7. (b) 8. (d) 9. (a) 10. (b)  
 11. (a) 12. (d) 13. (a, c) 14. (a, b) 15. (a, d)  
 16. (i)—(b), (ii)—(c), (iii)—(a), (iv)—(d)  
 17. (i)—(b), (ii)—(d), (iii)—(a), (iv)—(d), (v)—(c)  
 18. (b) 19. (a) 18. 6

## VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

**Q. 1. Define the term 'homopolymerisation' giving an example.**

**Ans.** The polymer formed by the polymerization of single/same monomeric species is known as homopolymerisation. E.g., Polythene/PVC/Polypropene.

**Q. 2. Give an example of elastomer.**

**Ans.** Natural rubber or Buna-S or Buna-N or Neoprene.

**Q. 3. Why is bakelite a thermosetting polymer ?**

**Ans.** Because bakelite have three dimensional network of covalent bonds with cross-linking between chains.

**Q. 4. Write the monomers of Buna-N.**

**Ans.**  $\text{H}_2\text{C} = \text{CH} - \text{CH} = \text{CH}_2$  +  $\text{H}_2\text{C} = \underset{\text{CN}}{\text{CH}}$   
 1,3 Butadiene Acrylonitrile

**Q. 5. Is  $\text{[H}_2\text{C CH(C}_6\text{H}_5\text{)]}_n$  a homopolymer or copolymer ? Why ?**

**Ans.** Homopolymer, because it is formed by polymerization of one kind of monomer species.

**Q. 6. Write the structure and one use of urea formaldehyde resin.**

**Ans.**  $\text{[HNCONHCH}_2\text{]}_n$

It is used in unbreakable crockery.

**Q. 7. Is  $\text{[H}_2\text{C}-\underset{\text{Cl}}{\text{CH}}\text{]}_n$  a homopolymer or a copolymer ?**

**Ans.** Homopolymer.

**Q. 8. Which of the following is natural polymer ?**

**Buna-S, Proteins, PVC**

**Ans.** Proteins.

**Q. 9. Based on molecular forces what type of polymer is neoprene ?**

**Ans.** Elastomer.

**Q. 10. Which of the following is a fibre ?**

**Nylon, Neoprene, PVC**

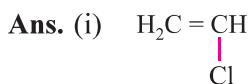
**Ans.** Nylon

### SHORT ANSWER-I TYPE QUESTIONS (2 Marks)

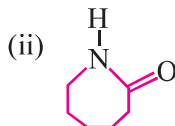
**Q. 1. Draw the structure of monomers of each of the polymers :**

(i) PVC

(ii) Nylon-6



Vinyl chloride



Caprolactum

**Q. 2. What is the repeating unit in the condensation polymer obtained by combining  $\text{HOOCCH}_2\text{CH}_2\text{COOH}$  (succinic acid) and  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$  (ethylene diamine) ?**



**Q. 3. Draw the structure of monomers of the following polymers :**

(i) Teflon

(ii) Polythene

**Ans. (i)**  $\text{F}_2\text{C}=\text{CF}_2$  Tetrafluoroethene

(ii)  $\text{H}_2\text{C}=\text{CH}_2$  Ethene

**Q. 4. Name the two groups into which polymers are classified on the basis of magnitude of intermolecular forces.**

**Ans. (i)** Elastomers

(ii) Fibres

(iii) Thermoplastic polymers

(iv) Thermosetting polymers



**Q. 5. Mention two important uses of each of the following :**

- (i) Bakelite                      (ii) Nylon-6

**Ans. (i) Bakelite :** For making combs, electrical switches, handles of utensils, computer disc etc.

(ii) **Nylon-6 :** For making tyre cords, fabrics, ropes etc.

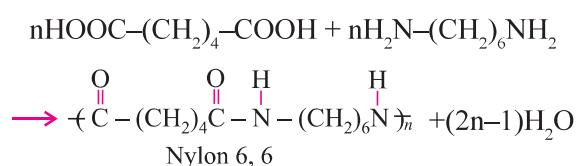
**Q. 6. Distinguish between homopolymers and copolymers with an example of each.**

**Ans. Homopolymers :** Polymers whose repeating structural units are derived from only one type of monomer units are called homopolymers. For example, Polythene.

**Copolymers :** Polymers whose repeating structural units are derived from two or more types of monomer units are called copolymers. For example, Nylon-6, 6.

**Q. 7. What is step growth polymerisation ? Explain with an example.**

**Ans.** Step growth polymerisation involves condensation between monomers having multifunctional groups. It is also known as condensation polymerisation. E.g.,



**Q. 8. What is the difference between elastomers and fibres ? Give one example of each.**

**Ans. Elastomers :** Polymers in which the intermolecular forces of attraction between the polymer chains are weakest are called elastomers. E.g., Natural rubber.

**Fibres :** Polymers in which intermolecular forces of attraction are the strongest are called fibres. E.g., Nylon-6, 6.

**Q. 9. Mention the important uses of each :**

- (i) Nylon-6, 6                      (ii) PVC

**Ans. (i) Uses of Nylon-6, 6 :**

- (a) It is used in making carpets, textile fibres etc.  
 (b) It is used for making elastic hosiery.

(ii) **Uses of PVC :**

- (a) It is used for making raincoats, hand bags etc.
- (b) It is used in making water pipes.

**Q. 10. Arrange the following polymers in the order of increasing intermolecular forces :**

- (i) **Nylon-6, Buna-S, Polythene**
- (ii) **Nylon-6, Neoprene, Polyvinyl chloride**

**Ans.** (i) Buna-S < Polythene < Nylon-6

(ii) Neoprene < Polyvinyl chloride < Nylon-6

**Q. 11. Define thermoplastic and thermosetting polymers. Give one example of each.**

**Ans. Thermoplastics :** Polymers in which the intermolecular forces of attraction are in between those of elastomers and fibres are called thermoplastics. E.g., Nylon-6, PVC, etc.

**Thermosetting polymers :** These are semi-fluid substances with low molecular masses which when heated in a mould undergo a permanent change in chemical composition to give hard, infusible and insoluble mass. E.g., Bakelite.

**Q. 12. What is biodegradable polymer ? Give an example of a biodegradable polymer.**

**Ans.** Biodegradable polymers are those which are decomposed by micro organisms. E.g., PHBV (Poly-B-hydroxybutyrate – Co – B – hydroxyl valerate).

**Q. 13. How does vulcanization change the character of natural rubber ?**

**Ans.** It introduces sulphur bridge or cross-link between polymer chain.

**Q. 14. Name a polymer each for the following applications :**

- (i) **Insulation of electrical switches**
- (ii) **Making laminated sheets**

**Ans.** (i) Bakelite

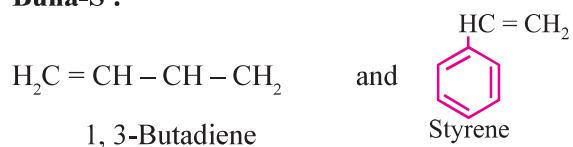
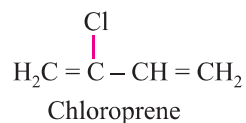
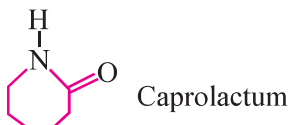
(ii) Urea formaldehyde resin

**Q. 15. How does the presence of double bonds in rubber influence their structure and reactivity ?**

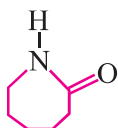
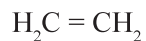
**Ans.** Natural rubber is a cis-polyisoprene. These cis- double bonds do not allow to polymer unit to come close for effective interaction. Hence rubber shows elasticity.

**SHORT ANSWER-II TYPE QUESTIONS (3 Marks)****Q. 1. Write the names and structure of the monomers of the following polymers :**

- (i) **Buna-S**                      (ii) **Neoprene**                      (iii) **Nylon-6**

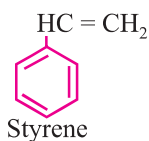
**Ans. (i) Buna-S :****(ii) Neoprene :****(iii) Nylon-6 :****Q. 2. Write names and structure of monomers of following polymers :**

- (i) **Bakelite**                      (ii) **Nylon-6**                      (iii) **Polythene**

**Ans. (i) Phenol and formaldehyde****(ii) Caprolactum****(iii) Ethene****Q. 3. Write names and structure of monomers of following polymers :**

- (i) **Polystyrene**                      (ii) **Dacron**                      (iii) **Teflon**

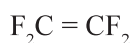
Ans. (i) Styrene



(ii) Ethylene glycol + Terephthalic acid



(iii) Tetrafluoroethene



Q. 4. (i) What is the role of t-butyl peroxide in the polymerisation of ethane ?

(ii) Identify the monomers in the following polymer :



(iii) Arrange the following polymers in the increasing order of their intermolecular forces :

Polystyrene, Terylene, Buna-S

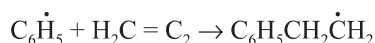
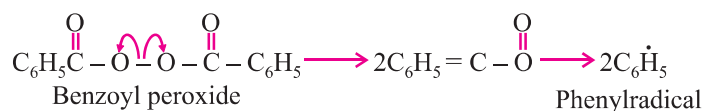
Ans. (i) Catalyst/initiator of free radical

(ii) Hexamethylenediamine and adipic acid

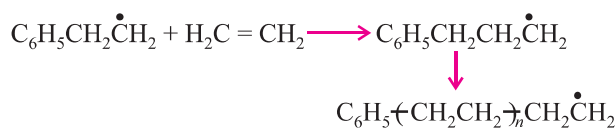
(iii) Buna-S < Polystyrene < Terylene

Q. 5. Write the mechanism of free radical polymerisation of ethane.

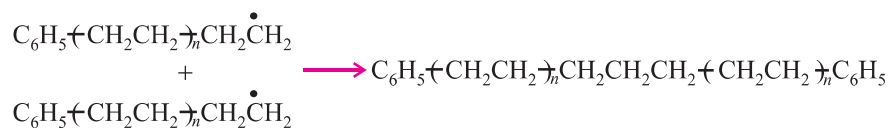
Ans. (i) Chain initiation step



(ii) Chain propagating step



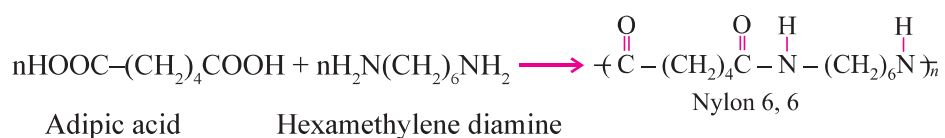
(iii) Chain terminating step



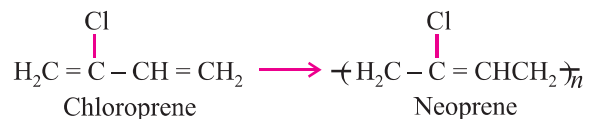
**Q. 6. Write chemical equation for the synthesis of :**

(i) Nylon-6, 6      (ii) Neoprene      (iii) Terylene

**Ans. (i) Nylon-6, 6 :**

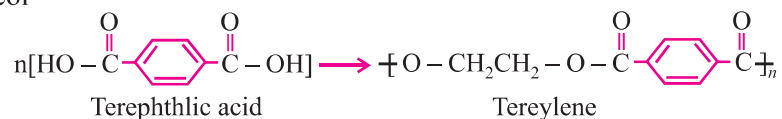


**(ii) Neoprene :**



**(iii) Terylene :**

$n\text{HO-CH}_2\text{CH}_2\text{OH} +$   
Ethylene glycol



**Q. 7. Write the monomers which are used for the synthesis of following polymers :**

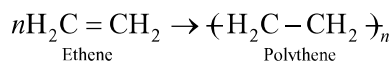
(i) Terylene      (ii) Polythene      (iii) Bakelite

**Indicate the type of polymerisation for each which forms polymers.**

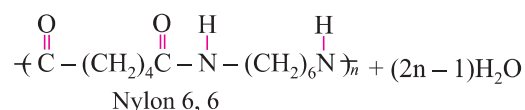
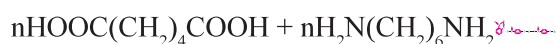
Ans.	Monomers	Type of polymerisation
(i)	Ethylene glycol + Terephthalic acid	Condensation
(ii)	Ethene	Addition
(iii)	Phenol + Formaldehyde	Condensation

**Q. 8. How are polymers classified on the basis of mode of polymerisation ? Explain with examples.**

**Ans. Addition polymers :** Are formed by repeated addition of a large number of same or different monomers possessing double or triple bonds. E.g., Polythene.



**Condensation polymers :** Are formed by repeated condensation reaction between two bifunctional or trifunctional monomer units usually with the elimination of small molecules like water, alcohol, ammonia, etc. E.g., Nylon-6, 6.

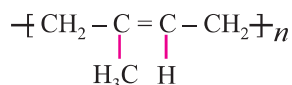


**Q. 9. A monomer of a polymer on ozonolysis gives two moles of  $\text{CH}_2\text{O}$  and one mol of  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CHO}$ . Write the structure of monomer and polymer and each step of reaction.**

**Ans. Structure of monomer :**



**Structure of polymer :**



**Q. 10. Can a copolymer be formed in both addition and condensation polymerisation ? Explain with examples.**

**Ans.** Yes. Buna-S, Buna-N : Addition polymer

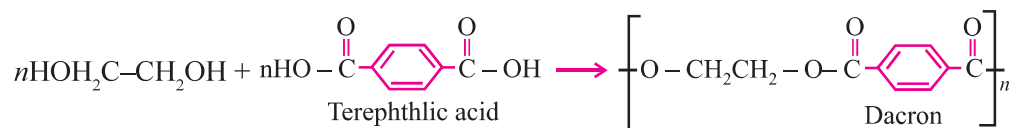
Nylon-6, 6, terylene : Condensation

### LONG ANSWER TYPE QUESTIONS (5 Marks)

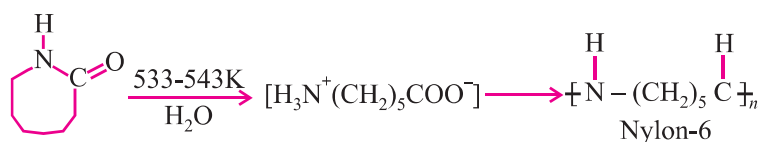
**Q. 1. How are following polymers obtained ? Write the names and structures of monomers and structure of respective polymers :**

- |              |              |              |
|--------------|--------------|--------------|
| (i) Dacron   | (ii) Nylon-6 | (iii) Buna-N |
| (iv) Glyptal | (v) PHBV     |              |

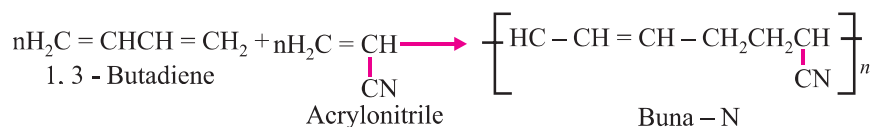
**Ans. (i) Dacron :** By condensation polymerisation.



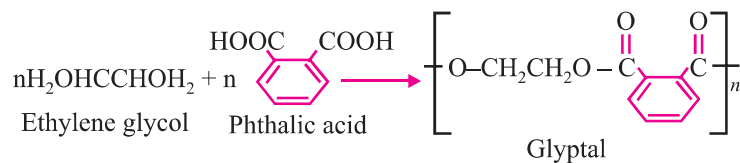
**(ii) Nylon-6 :** By condensation polymerisation.



**(iii) Buna-N :** By addition polymerisation.



**(iv) Glyptal :** By condensation polymerisation.



**(v) PHBV :** By condensation polymerisation.

