Chapter_15

Polymers

Practice Questions

1. The molecular mass of polymer is in the range of
(a) 10^{10} - 10^{15} u *(b)* 10^{3} - 10^{7} u
(c) 10^{6} - 10^{18} u *(d)* 10^{1} - 10^{3} u

2. To which category of polymers, cellulose derivatives belong to?
(a) Synthetic polymers *(b)* Semi-synthetic polymers
(c) Natural polymers *(d)* Branched polymers

3. Buna-S is a
(a) natural polymer *(b)* synthetic polymer
(c) semi-synthetic polymer *(d)* None of these

4. PVC is a
(a) linear polymer *(b)* branched polymer
(c) cross-linked polymer *(d)* None of these

5. What is full form of HDP?
(a) High density polythelene
(b) High density polythene
(c) High density polypropene
(d) High density polypropylene

6. Polymers containing linear chains having some branches are known as
(a) network polymers *(b)* branched polymers
(c) linear polymers *(d)* cross-linked polymers

7. Which one of the following is a network polymer?
(a) HDP *(b)* Bakelite
(c) LDP *(d)* Polyvinyl chloride

8. Buna-S is a copolymer of
(a) ethene and styrene *(b)* 1, 3-butadiene and ethene
(c) 1, 3-butadiene and styrene *(d)* ethene and propene

9. Rubber like solids with elastic properties are called
(a) elastomers
(b) fibres
(c) thermosetting polymers
(d) thermoplastic polymers

10. Polymer which contains strong intermolecular forces, e.g. hydrogen bonding is
(a) polystyrene *(b)* nylon-6,6
(c) teflon *(d)* natural rubber

11. The repeated addition of same monomer molecules having double or triple bonds is known as
(a) copolymer *(b)* elastomer
(c) homopolymer *(d)* fibre

12. Low density polythene is obtained through
(a) electrophilic addition
(b) free radical addition
(c) nucleophilic addition
(d) nucleophilic substitution

13. LDP is used in the insulation of electricity wires and manufacture of flexible pipes because
(a) it is chemically inert
(b) it is tough and flexible
(c) it is poor conductor of electricity
(d) All of the above

14. The type of polythene which is chemically inert and more tough and hard is
(a) HDP *(b)* LDP
(c) Both (a) and (b) *(d)* None of these

15. The commercial name of polyacrylonitrile is
(a) orlon (acrilan) *(b)* dacron
(c) bakelite *(d)* melamine

16. Nylon is an example of
(a) polyester *(b)* polysaccharide
(c) polyamide *(d)* polythene

17. $\left[\mathrm{NH(CH_2)_6NHCO(CH_2)_4CO}\right]_n$ is a
(a) homopolymer *(b)* condensation polymers
(c) addition polymer *(d)* thermosetting polymer

18. The monomers of dacron, a polyester is/are
(a) ethylene glycol *(b)* terephthalic acid
(c) caprolactam *(d)* Both (a) and (b)

19. Preparation of bakelite proceeds *via* reactions
(a) electrophilic addition and dehydration
(b) condensation and elimination
(c) nucleophilic addition and dehydration
(d) electrophilic substitution and dehydration

20. Among the following polymers, the phenol formaldehyde resin is
(a) teflon *(b)* bakelite
(c) melamine *(d)* buna-N

21. In natural rubber, few cross-links are introduced in between the chains. These chains help to
(a) make the rubber soft
(b) retract the original position after the force is released
(c) make the rubber hard
(d) None of the above

22. Which is the monomer of neoprene in the following?
(a) $CH_2=CH-C\equiv CH$
(b) $CH_2=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH=CH$
(c) $CH_2=\underset{\displaystyle Cl}{\underset{|}{C}}-CH=CH_2$
(d) $CH_2=CH-CH=CH_2$

23. Which polymer has 'chiral' monomer(s)?
(a) PHBV *(b)* Buna-N
(c) Nylon-6, 6 *(d)* Neoprene

24. Biodegradable polymer which can be produced from glycine and amino caproic acid is
(a) nylon-2-nylon-6 *(b)* PHBV
(c) buna-N *(d)* nylon-6, 6

25. Among the following, which polymer is used for making combs, electrical switches, handles of utensils and computer discs?
(a) Bakelite
(b) Glyptal
(c) Polystyrene
(d) PVC

ANSWERS

1.	(b)	**2.**	(b)	**3.**	(b)	**4.**	(a)	**5.**	(b)	**6.**	(b)	**7.**	(b)	**8.**	(c)	**9.**	(a)	**10.**	(b)
11.	(c)	**12.**	(b)	**13.**	(c)	**14.**	(a)	**15.**	(a)	**16.**	(c)	**17.**	(b)	**18.**	(d)	**19.**	(d)	**20.**	(b)
21.	(b)	**22.**	(c)	**23.**	(a)	**24.**	(a)	**25.**	(a)										

Hints & Solutions

1. (*b*) The molecular mass of polymer is in the range of 10^3-10^7 u. These are very large molecules having high molecular mass. Hence, these are also referred as macromolecules.

2. (*b*) Cellulose derivatives such as cellulose acetate and cellulose nitrate are semi-synthetic polymers.

3. (*b*) Buna-S is a synthetic polymer, also known as man-made polymer.

4. (*a*) PVC (Polyvinyl chloride) is linear polymer as it contains long and straight chains.

5. (*b*) HDP stands for high density polythene. It is a linear polymer.

6. (*b*) Polymers containing linear chains having some branches are known as branched polymers.

It is represented as,

Branched polymer

7. (*b*) Bakelite is a network or cross-linked polymer as it contains several covalent bonds between various linear polymer.

8. (*c*) Buna-S is a copolymer of 1, 3-butadiene and styrene. The reaction involved is as follows :

$$n\underset{\text{1, 3-butadiene}}{CH_2=CH-CH=CH_2} + n\underset{\text{Styrene}}{C_6H_5CH=CH_2}$$

$$\longrightarrow -\left(CH_2-CH=CH-CH_2-\underset{C_6H_5}{\underset{|}{CH}}-CH_2\right)_n$$

Buna-S

9. (*a*) Elastomers are rubber like-solids with elastic properties like-neoprene, buna-S, buna-N, etc.

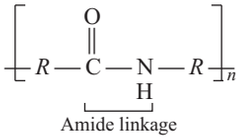
10. (*b*) Nylon-6,6 contains strong intermolecular forces like H-bonding. These strong forces lead to close packing of chains and impart crystalline nature.

11. (*c*) The repeated addition of same monomer molecules having double or triple bonds is known as homopolymer.

13. (*c*) Low density polythene (LDP) is used in the insulation of electricity wires and manufacture of flexible pipes and squeeze bottles because it is chemically inert, tough, flexible and poor conductor of electricity.

14. (*a*) The type of polythene which is chemically inert and more tough and hard is HDP (High Density Polythene). It consist of linear molecules and have high density.

16. (*c*) Nylon is an example polyamide containing amide linkages $-(-CONH-)-$. It is prepared by condensation copolymerisation of diamines with dicarboxylic acids or by condensation polymerisation of lactam.

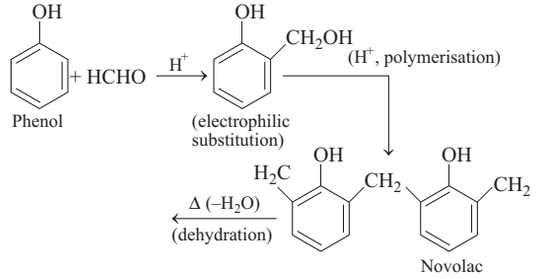


Amide linkage

17. (*b*) $-(-NH(CH_2)_6NHCO(CH_2)_4CO-)_n$ is obtained by the condensation of hexamethylene diamine and adipic acid. It is a copolymer.

18. (*d*) The monomers of dacron are ethylene glycol and terephthalic acid. It is manufactured by heating a mixture of glycol and terephthalic acid at 420 to 460 K in the presence of zinc acetate-antimony trioxide catalyst.

19. (*d*) Preparation of bakelite proceeds *via* electrophilic substitution and dehydration reactions. It is shown below:



20. (*b*) Bakelite is the phenol-formaldehyde resin.

It is obtained by heating novolac with formaldehyde.

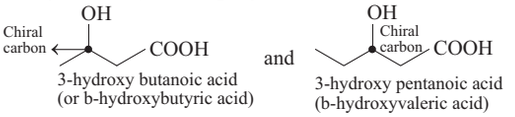
21. (*b*) In natural rubber, few cross-links are introduced in between the chains, which help the polymers to retract the original position after the force is released.

22. (*c*) Option (c) is a monomer of neoprene, i.e chloroprene. Chemically, it is 2-chlorobutane-1, 3-diene. It is obtained by free radical polymerisation of chloroprene. Complete reaction is as follows :

$$n\underset{\substack{\text{(2-chloro-1, 3-butadiene)}\\\text{Chloroprene}}}{CH_2=\underset{Cl}{\underset{|}{C}}-CH=CH_2} \xrightarrow{\text{Polymerisation}} \left[CH_2-\underset{Cl}{\underset{|}{C}}=CH-CH_2\right]_n$$

Neoprene

23. (*a*) PHBV, (Poly 3- hydroxybutyrate -co-3-hydroxyvalerate) is a copolymer of



In both monomers, there is one chiral centre (shown by dark spot).

∴ Polymer contains chiral monomers.

24. (*a*) Nylon-2-nylon-6 is the biodegradable polymer that can be produced from glycine (containing two carbon atoms) and aminocaproic acid or 6-aminohexanoic acid (containing six carbon atoms). Reaction involved is as follows :

$$n\underset{\text{Glycine}}{H_2N-CH_2-COOH} + n\underset{\text{Amino caproic acid}}{H_2N-(CH_2)_5-COOH}$$

$$\longrightarrow \left[-NH-CH_2-\underset{\underset{O}{\|}}{C}-NH-(CH_2)_5-\underset{\underset{O}{\|}}{C}-\right]_n$$

Nylon-2-nylon-6

It is a biodegradable polyamide copolymer.