CHAPTER 27

## Polymers

1. The copolymer formed by addition polymerization of styrene and acrylonitrile in the presence of peroxide is



- 2. Which of the following statements is not true?
  - (a) Nylon-6 is an example of step-growth polymerisation.
  - (b) Chain growth polymerisation involves homopolymerisation only.
  - (c) Step-growth polymerisation requires a bifunctional monomer.
  - (d) Chain growth polymerisation includes both homopolymerisation and copolymerisation.

(Online 2018)

3. The formation of which of the following polymers involves hydrolysis reaction?

(c) Nylon 6 (d) Bakelite (2017)4. Which of the following is a biodegradable polymer?

(a) 
$$[HN-(CH_{2})_{6}NHCO - (CH_{2})_{4} - C]_{n}$$
  
(b)  $[HN - (CH_{2})_{5}CONH - CH_{2} - C]_{n}$   
(c)  $[HN - (CH_{2})_{5} - C]_{n}$   
(d)  $[C - (CH_{2})_{5} - COO - (CH_{2})_{2} - O]_{n}$   
(Online 2017)

- 5. Which of the following statements about low density polythene is false?
  - (a) Its synthesis requires high pressure.
  - (b) It is a poor conductor of electricity.
  - (c) Its synthesis requires dioxygen or a peroxide initiator as a catalyst.
  - (d) It is used in the manufacture of buckets, dust-bins etc. (2016)
- 6. Assertion : Rayon is a semisynthetic polymer whose properties are better than natural cotton.

**Reason :** Mechanical and aesthetic properties of cellulose can be improved by acetylation.

- (a) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion.
- (b) Both assertion and reason are correct, and the reason is the correct explanation for the assertion.
- (c) Assertion is incorrect statement, but the reason is correct.
- (d) Both assertion and reason are incorrect.

(Online 2016)

- 7. Which of the following polymers is synthesized using a free radical polymerization technique?
  - (a) Terylene (b) Melamine polymer
  - (c) Nylon 6, 6 (d) Teflon (Online 2016)
- 8. Which polymer is used in the manufacture of paints and lacquers?
  - (a) Polypropene
    (b) Polyvinyl chloride
    (c) Bakelite
    (d) Glyptal (2015)
    - $\mathbf{Dakente} \qquad (\mathbf{u}) \mathbf{Otypian} \qquad (2015)$
- **9.** Match the polymers in column-A with their main uses in column-B and choose the correct answer.
  - Column-AColumn-B(A) Polystyrene(i) Paints and lacquers(B) Glyptal(ii) Rain coats
  - (C) Polyvinyl chloride (iii) Manufacture of toys
  - (D) Bakelite (iv) Computer discs (a) (A) - (ii), (B) - (i), (C) - (iii), (D) - (iv)
  - (a) (A) (ii), (B) (i), (C) (ii), (D) (iv) (b) (A) - (iii), (B) - (i), (C) - (ii), (D) - (iv)
  - (c) (A) (ii), (B) (iv), (C) (iii), (D) (i)
  - (d) (A) (iii), (B) (iv), (C) (ii), (D) (i) (Online 2015)
- **10.** Which one of the following structures represents the neoprene polymer?

(a) 
$$-J O_7 - J = J O - J O_7 - (b) - J O_7 - O$$

	(c) $-J O_7 - J O_7$	(d) $-J O J O_7 \cdot O_7 \cdot J_5 O_5$	-		(c) $H_2C \equiv CH - CN$ and (d) $H_2C \equiv CH - CN$ and	$H_2C = CH - CH = CH$ $H_2C = CH - C = CH$	2 (2009)
11.	Which one is classified as (a) Acrylonitrile	<i>(Onlin</i> a condensation polyme (b) Dacron	e 2015) r?	15.	Bakelite is obtained from (a) HCHO (c) CH <sub>3</sub> CHO	phenol by reaction wi (b) $(CH_2OH)_2$ (d) $CH_3COCH_3$	th (2008)
12.	(c) Neoprene The species which can bes cationic polymerization is	(d) Teflon st serve as an initiator	(2014) for the	16.	<ul><li>Which of the following is</li><li>(a) Neoprene</li><li>(c) Thiokol</li></ul>	fully fluorinated polyme (b) Teflon (d) PVC	er? (2005)
13.	<ul> <li>(a) HNO<sub>3</sub></li> <li>(c) BuLi</li> <li>The polymer containing str</li> </ul>	<ul> <li>(b) AlCl<sub>3</sub></li> <li>(d) LiAlH<sub>4</sub></li> <li>ong intermolecular for</li> </ul>	(2012)	17.	<ul><li>Which of the following is</li><li>(a) Teflon</li><li>(c) Terylene</li></ul>	a polyamide? (b) Nylon-6,6 (d) Bakelite	(2005)
	hydrogen bonding is (a) natural rubber (c) nylon-6,6	(b) teflon (d) polystyrene.	(2010)	18.	Nylon threads are made o (a) polyvinyl polymer (c) polyamide polymer	f (b) polyester polymer (d) polyethylene poly	mer.
14.	4. Buna-N synthetic rubber is a co-polymer of (a) $H_2C = CH - C = CH_2$ and $H_2C = CH - CH = CH_2$			19.	(2) Polymer formation from monomers starts by (a) condensation reaction between monomers (b) coordinate reaction between monomers		

- (b)  $H_2C = CH CH = CH_2$  and  $H_5C_6 CH = CH_2$
- (c) conversion of monomer to monomer ions by protons(d) hydrolysis of monomers. (2002)
- (2002)

ANSWER KEY												
1.	(d)	<b>2.</b> (b)	<b>3.</b> (c)	<b>4.</b> (b)	5. (d)	<b>6.</b> (b)	7. (d)	<b>8.</b> (d)	<b>9.</b> (b)	<b>10.</b> (a)	<b>11.</b> (b)	12. (b)
13.	(c)	14. (c)	<b>15.</b> (a)	<b>16.</b> (b)	17. (b)	<b>18.</b> (c)	<b>19.</b> (a)					



1. (d) : Polymerisation of styrene with acrylonitrile occurs in presence of peroxide.



**2.** (b) : Chain-growth polymerisation is an addition polymerisation which involves homopolymeri-sation and copolymerisation both.

**3.** (c): (a) Nylon 6, 6 is prepared by the condensation polymerisation of hexamethyl-enediamine with adipic acid under high pressure and high temperature.

(b) Terylene is prepared by condensation polymerisation of ethylene glycol and terephthalic acid.



(c) Nylon 6 is prepared when caprolactam is hydrolysed to produce caproic acid which further undergoes condensation to produce nylon 6.

$$\bigcup_{\text{Caprolactam}}^{H} \bigcup_{H_2O}^{O} \xrightarrow{533-543 \text{ K}} [H_3N - (CH_2)_5 - COO]$$

$$\xrightarrow{\Delta/\text{polymerisation}}_{-(n-1)\text{H}_2\text{O}} \left[ \text{NH} - (\text{CH}_2)_5 - \overset{\text{O}}{\text{C}} \right]_n$$

(d) Novolac on heating with formaldehyde undergoes crosslinkage to form bakelite.



It is a polymer of glycine and aminocaproic acid and is a biodegradable polymer.

5. (d): High density polythene is used to manufacture buckets, dust-bins, etc. while low density polythene is used for manufacturing flexible pipes, insulation of electrical wires etc. due to its poor conductivity and slight flexibility.

**6.** (b) : The strength of cellulose is improved by acetylation to form rayon, a semisynthetic polymer which is better than natural cotton.

7. (d) : Terylene, Melamine and Nylon-6,6 are condensation polymers. Teflon is an addition polymer which is formed by free radical polymerization of its monomer,  $(CF_2 = CF_2)$ . 8. (d)

•••	(4)					
9.	(b) : Polymer	Use				
	Polystyrene	Manufacture of toys				
	Glyptal	Paints and lacquers				
	PVC Rain coats					
	Bakelite	Computer discs				

10. (a) :

$$\begin{bmatrix} O_7 = J & -J & O = J & O_7 & \underline{6192nppuulz} \\ J & & & | \{x \ y \ q -u+npulz \\ J \ x & & -J & O_7 - J = J & O - J & O_7 \\ & & & J \ x \\ & & & Vq\{| -qzq \end{bmatrix}$$

**11.** (b) : Dacron or terylene is a polyester, consists of ester linkages formed by the condensation of —OH group of ethylene glycol and —COOH group of terephthalic acid with elimination of water molecules.

12. (b) : Cationic polymerisation is initiated by use of strong Lewis acids such as  $H_2SO_4$ , HF, AlCl<sub>3</sub>, SnCl<sub>4</sub> or BF<sub>3</sub> in  $H_2O$ .

**13.** (c) : Nylon-6,6 involves amide (CONH) linkage therefore, it will also have very strong inter molecular hydrogen bonding between

NH-----OC group of two polyamide chains.

**14.** (c) : Buna-N is a co-polymer of butadiene and acrylonitrile.

$$nCH_{2} = CH - CH = CH_{2} + nCH_{2} = CH \xrightarrow{I}$$

$$nCH_{2} = CH - CH_{2} = CH \xrightarrow{I}$$

$$Acrylonitrile$$

$$CN$$

$$H$$

$$CH_{2} - CH = CH - CH_{2} - CH_{2} - CH_{n}$$

Buna-N **15.** (a) : Bakelite is a thermosetting polymer which is made by reaction between phenol and HCHO.

16. (b): Neoprene :  $\begin{array}{c} CI \\ CH_2 - CH = C - CH_2 \end{array} \right]_n$ Teflon :  $\begin{array}{c} CF_2 - CF_2 \end{array} \right]_n$ Thiokol :  $- CH_2 \end{array} \begin{array}{c} CH_2 - S - S - CH_2 \end{array} \right]_n CH_2 - S - S - CH_2CH_2 -$ 

$$PVC : \begin{bmatrix} CH_2 - CH \\ I \\ Cl \end{bmatrix}_n$$

**17.** (b) : Polymers having amide linkages (- CONH) are known as polyamides.

 $n(H_2N(CH_2)_6NH_2) + n(HOOC(CH_2)_4COOH) \longrightarrow$ Hexamethylene diamine Adipic acid

$$-+ HN - (CH_2)_6 - \overline{NHCO} - (CH_2)_4 - CO - \frac{1}{n}$$
  
Nylon-6, 6

**18.** (c) : Nylon threads are polyamides. They are the condensation polymers of diamines and dibasic acids.

$$n \operatorname{HOOC}(\operatorname{CH}_{2})_{4}\operatorname{COOH} + n \operatorname{H}_{2}\operatorname{N}(\operatorname{CH}_{2})_{6}\operatorname{NH}_{2} \xrightarrow{280^{\circ}\operatorname{C}}{\text{high pressure}}$$
Adipic acid Hexamethylene diamine
$$\operatorname{HO} \left[\operatorname{OC} - (\operatorname{CH}_{2})_{4} - \operatorname{CONH}(\operatorname{CH}_{2})_{6}\operatorname{NH}\right]_{n}$$
Nylon (polyamide)

**19.** (a) : Polymerisation takes place either by condensation or addition reactions.

~≻**≔⊙**≓~