CHAPTER
29
POLYMERS

FACT/DEFINITION TYPE QUESTIONS

1. Which is not true about polymers?
(a) Polymers do not carry any charge
(b) Polymers have high viscosity
(c) Polymers scatter light
(d) Polymers have low molecular weight

2. Which of the following belongs to the class of natural polymers?
(a) Proteins (b) Cellulose
(c) Rubber (d) All of these

3. Which of the following natural products is not a polymer?
(a) DNA (b) Cellulose
(c) ATP (d) Urease

4. Among the following a natural polymer is
(a) cellulose (b) PVC
(c) teflon (d) polyethylene

5. Which of the following is not a biopolymer ?
(a) Proteins (b) Rubber
(c) Cellulose (d) RNA

6. Rayon is :
(a) synthetic plastic (b) natural rubber
(c) natural silk (d) artificial silk

7. Protein is a polymer of:
(a) glucose (b) terephthalic acid
(c) amino acids (d) None of these

8. Natural silk is a
(a) polyester (b) polyamide
(c) polyacid (d) polysaccharide

9. Polymers are:
(a) micromolecules (b) macromolecules
(c) sub-micromolecules (d) None of the above

10. Which of the following is/are a semisynthetic polymers?
(a) Cellulose acetate (b) Polyvinyl chloride
(c) Cellulose nitrate (d) Both (a) and (c)

11. Which of the following is not linear polymer ?
(a) Bakelite (b) Polyester
(c) Cellulose (d) High density polyethene

12. A polymer is formed when simple chemical units
(a) combine to form long chains
(b) combine to form helical chains
(c) break up
(d) become round

13. Polymer formation from monomers starts by
(a) condensation reaction between monomers
(b) coordinate reaction between monomers
(c) conversion of monomer to monomer ions by protons
(d) hydrolysis of monomers.

14. On the basis of mode of formation, polymers can be classified?
(a) as addition polymers only
(b) as condensation polymers only
(c) as copolymers
(d) both as addition and condensation polymers

15. In addition polymer monomer used is
(a) unsaturated compounds
(b) saturated compounds
(c) bifunctional saturated compounds
(d) trifunctional saturated compounds

16. Nylon 66 belongs to the class of
(a) Addition polymer
(b) Condensation polymer
(c) Addition homopolymer
(d) Condensation heteropolymer

17. A polymer made from a polymerization reaction that produces small molecules (such as water) as well as the polymer is classified as a/an ..... polymer.
(a) addition (b) natural
(c) condensation (d) elimination

18. In elastomer, intermolecular forces are
(a) strong (b) weak
(c) nil (d) None of these

19. A thermoplastic among the following is
(a) bakelite (b) polystyrene
(c) terylene (d) urea-formaldehyde resin

20. Which is an example of thermosetting polymer?
(a) Polythene (b) PVC
(c) Neoprene (d) Bakelite

21. Which of the following is thermoplastic ?
(a) Bakelite (b) Polyethylene
(c) Terylene (d) All of these

22. Thermosets are:
(a) cross-linked polymers
(b) don't melt or soften on heating
(c) cross-linking is usually developed at the time of moulding where they harden reversibly
(d) all of the above

23. Which is/are true for elastomers?
(a) These are synthetic polymers possessing elasticity
(b) These possess very weak intramolecular forces or attractions between polymer chains
(c) Vulcanised rubber is an example of elastomer
(d) All of the above

24. Among the following polymers the strongest molecular forces are present in
(a) elastomers (b) fibres
(c) thermoplastics (d) thermosetting polymers

25. Three dimensional molecular structure with cross links are formed in the case of a
(a) thermoplastic (b) thermosetting plastic
(c) Both (a) and (b) (d) None of the above

26. Which of the following polymer is an example of fibre ?
(a) Silk (b) Dacron
(c) Nylon-66 (d) All of these

27. Which of the following statements is not correct for fibres?
(a) Fibres possess high tensile strength and high modulus.
(b) Fibres impart crystalline nature.
(c) Characteristic features of fibres are due to strong intermolecular forces like hydrogen bonding.
(d) All are correct.

28. Which of the following is/are examples of fibres?
(a) Polyesters (b) Polyamide
(c) Polythene (d) Both (a) and (b)

29. Which of the following can be repeatedly soften on heating?
(i) Polystyrene (ii) Melamine
(iii) Polyesters (iv) Polyethylene
(v) Neoprene
(a) (i) and (iii) (b) (i) and (iv)
(c) (iii), (iv) and (v) (d) (ii) and (iv)

30. Which of the following does not undergo addition polymerization?
(a) Vinylchloride
(b) Butadiene
(c) Styrene
(d) All of the above undergoes addition polymerizations

31. Which of the following is a cross linked polymer?
(a) PVC (b) Bakelite
(c) Polyethylene (d) Rubber

32. Fibres that have good resistance to stains, chemicals, insects and fungi is
(a) Acrylic (b) Terylene
(c) Nylon (d) All of these

33. Which of the following statements is not true about low density polythene?
(a) Tough
(b) Hard
(c) Poor conductor of electricity
(d) Highly branched structure

34. Low density polythene is prepared by
(a) Free radical polymerisation
(b) Cationic polymerisation
(c) Anionic polymerisation
(d) Ziegler-Natta polymerisation

35. The monomer of teflon is
(a) $CHF=CH_2$ (b) $CF_2=CF_2$
(c) $CHCl=CHCl$ (d) $CHF=CHCl$

36. The monomer(s) used in the preparation of Orlon, a substitute for wool is/are
(a) caprolactam
(b) tetrafluoroethene
(c) styrene and 1, 3-butadiene
(d) acrylonitrile

37. Orlon is a polymer of
(a) styrene (b) tetrafluoroethylene
(c) vinyl chloride (d) acrylonitrile

38. Which of the following polymer is used for manufacturing of buckets, dustbins, pipes etc ?
(a) Low density polythene
(b) High density polythene
(c) Teflon
(d) Polyacrylonitrile

39. Which of the following catalyst is used in preparation of high density polythene ?
(a) Peroxide catalyst
(b) Ziegler - Natta catalyst
(c) Wilkinson's catalyst
(d) Pd - catalyst

40. Which of the following statements is false?
(a) Artificial silk is derived from cellulose.
(b) Nylon-66 is an example of elastomer.
(c) The repeat unit in natural rubber is isoprene.
(d) Both starch and cellulose are polymers of glucose.

41. Melamine plastic crockery is a copolymer of:
(a) HCHO and melamine (b) HCHO and ethylene
(c) melamine and ethylene (d) None of these

42. Caprolactam polymerises to give
(a) terylene (b) teflon
(c) glyptal (d) nylon-6

43. Nylons, polysters and cotton, all posses strength due to:
(a) intermolecule H-bonding
(b) van der Waals' attraction
(c) dipole-dipole interaction
(d) None of the above

44. Nylon 66 is a polyamide obtained by the reaction of
(a) $COOH(CH_2)_4COOH + NH_2C_6H_4NH_2$
(b) $COOH(CH_2)_4COOH + NH_2(CH_2)_6NH_2$
(c) $COOH(CH_2)_6COOH + NH_2(CH_2)_4NH_2$
(d) $COOHC_6H_4COOH\text{–(p)} + NH_2(CH_2)_6NH_2$

45. Interparticle forces present in nylon-66 are
(a) van der waal's
(b) hydrogen bonding
(c) dipole-dipole interactions
(d) None of these

46. The plastic household crockery is prepared by using
(a) melamine and tetrafluoroethane
(b) malonic acid and hexamethyleneamine
(c) melamine and vinyl acetate
(d) melamine and formaldehyde

47. Which of the following is currently used as a tyre cord ?
(a) Terylene (b) Polyethylene
(c) Polypropylene (d) Nylon - 6

48. Of the following which one is classified as polyester polymer ?
(a) Terylene (b) Bakelite
(c) Melamine (d) Nylon-66

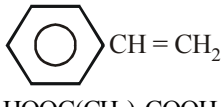
49. Which one of the following is not a condensation polymer ?
(a) Melamine (b) Glyptal
(c) Dacron (d) Neoprene

50. Bakelite is obtained from phenol by reacting with
(a) $(CH_2OH)_2$ (b) CH_3CHO
(c) CH_3COCH_3 (d) HCHO

51. The polymer containing strong intermolecular forces e.g. hydrogen bonding, is
(a) teflon (b) nylon 6, 6
(c) polystyrene (d) natural rubber

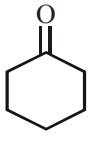
52. Nylon threads are made of
(a) polyester polymer (b) polyamide polymer
(c) polyethylene polymer (d) polyvinyl polymer

53. Which compound/set of compounds is used in the manufacture of nylon 6?

(a) 

(b) $HOOC(CH_2)_4COOH + NH_2(CH_2)_6NH_2$

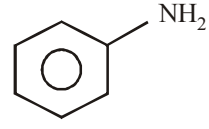
(c) $CH_2 = CH - \overset{CH_3}{\overset{|}{C}} = CH_2$

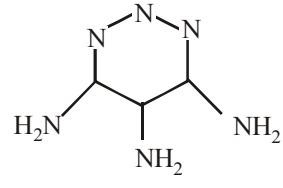
(d) 

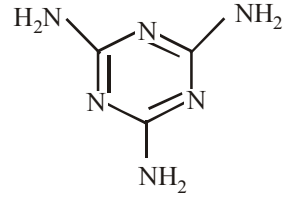
54. The repeating unit present in Nylon 6 is
(a) —[NH(CH$_2$)$_6$NHCO(CH$_2$)$_4$CO]—
(b) —[CO(CH$_2$)$_5$NH]—
(c) —[CO(CH$_2$)$_6$NH]—
(d) —[CO(CH$_2$)$_4$NH]—

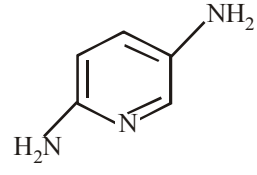
55. Which of the following polymer is a polyamide ?
(a) Terylene (b) Nylon
(b) Rubber (d) Vulcanised rubber

56. Which of the following compound is used for preparation of melamine formaldehyde polymer ?

(a) 

(b) 

(c) 

(d) 

57. Acetic acid is added in the preparation of Nylon-6 due to
(a) initiate polymerisation
(b) avoid polymerisation at first step
(c) avoid oxidation
(d) removal of water

58. The bakelite is made from phenol and formaldehyde. The initial reaction between the two compounds is an example of:
(a) aromatic electrophilic substitution
(b) aromatic nucleophilic substitution
(c) free radical reaction
(d) aldol reaction

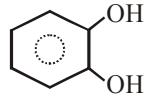
59. Melamine plastic crockery is a codensation polymer of
(a) HCHO and melamine
(b) HCHO and ethylene
(c) melamine and ethylene
(d) None of these

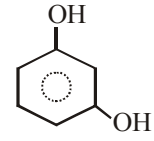
60. Which of the following polymer is used for making phonograph records ?
(a) Bakelite (b) Dacron
(c) Teflon (d) PVC

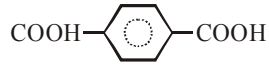
61. Novolac is
(a) cross-linked polymer (b) linear polymer
(c) addition polymer (d) synthetic rubber

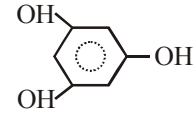
62. Dacron is a –
(a) crease resistant
(b) polyamide
(c) addition polymer
(d) polymer of ethylene glycol and phthalic acid

63. The monomeric units of terylene are glycol and which of the following

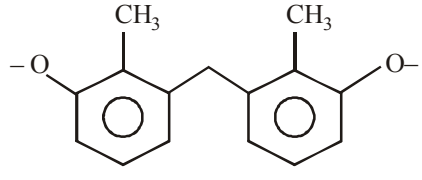
(a) 

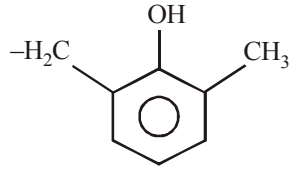
(b) 

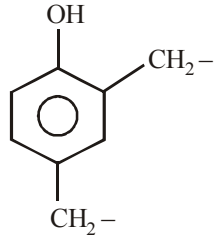
(c) 

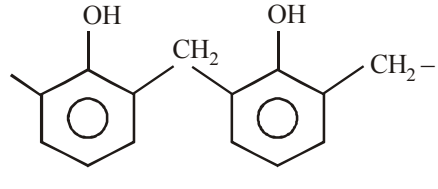
(d) 

64. Which of the following is novolac ?

(a) 

(b) 

(c) 

(d) 

65. Soft drinks and baby feeding bottles are generally made up of
(a) Polystyrene (b) Polyurethane
(c) Polyurea (d) Polyamide

66. Which is not an example of copolymer ?
(a) SAN (b) ABS
(c) Saran (d) PVC

67. Which of the following is an use of butadiene – styrene copolymer?
(a) Manufacture of autotyres
(b) Footwear components
(c) Cable insulation
(d) All of these

68. A homopolymer is obtained by polymerisation of:
(a) one type of monomer units
(b) two types of monomer units
(c) either of the above
(d) None of the above

69. A copolymer of isobutylene and isoprene is called:
(a) align butyl rubber (b) buna-S
(c) buna-N (d) thiokol

70. Which one is a homopolymer?
(a) Bakelite (b) Nylon
(c) Terylene (d) Neoprene

71. Polymerisation in which two or more chemically different monomers take part is called:
(a) addition polymerisation
(b) copolymerisation
(c) chain polymerisation
(d) homo polymerisation

72. Natural rubber is a polymer of
(a) butadiene (b) isoprene
(c) 2-methylbutadiene (d) hexa-1, 3-diene

73. Which one of the following statement is *not true*?
(a) In vulcanization the formation of sulphur bridges between different chains make rubber harder and stronger.
(b) Natural rubber has the *trans* -configuration at every double bond
(c) Buna-S is a copolymer of butadiene and styrene
(d) Natural rubber is a 1, 4 - polymer of isoprene

74. Natural rubber is polymer of
(a) $CH_2 = CH - Cl$

(b) cis $CH_2 = \underset{\displaystyle CH_3}{\underset{|}{C}} - CH = CH_2$

(c) trans $CH_2 = \underset{\displaystyle CH_3}{\underset{|}{C}} - CH = CH_2$

(d) cis $CH_2 = \underset{\displaystyle CH_3}{\underset{|}{C}} - \underset{\displaystyle CH_3}{\underset{|}{C}} = CH_2$

75. Which of the following is not the property of natural rubber
(a) Low tensile strength
(b) High water absorption capacity
(c) Soft and sticky
(d) High elasticity

76. Natural rubber is
(a) all trans polyisoprene (b) all cis-polysioprene
(c) chloroprene (d) Buna-N

77. The process involving heating of rubber with sulphur is called
(a) Galvanisation (b) Vulcanization
(c) Bessemerisaion (d) Sulphonation

78. Isoprene is a valuable substance for making
(a) propene (b) liquid fuel
(c) synthetic rubber (d) petrol

79. Synthetic polymer which resembles natural rubber is :
(a) neoprene (b) chloroprene
(c) glyptal (d) nylon

80. Synthetic rubber is:
(a) polyester (b) polyamide
(c) polysaccharide (d) poly (halodiene)

81. Which of the following are example of synthetic rubber?
(i) Polychloroprene (ii) polyacrylonitrile
(iii) Buna-N (iv) cis-polyisoprene
(a) (i) and (iii) (b) (i) and (ii)
(c) (iii) and (iv) (d) (ii) and (iii)

82. Buna-N synthetic rubber is a copolymer of :
(a) $H_2C = CH - CH = CH_2$ and $H_5C_6 - CH = CH_2$
(b) $H_2C = CH - CN$ and $H_2C = CH - CH = CH_2$
(c) $H_2C = CH - CN$ and $H_2C = CH - \underset{\displaystyle CH_3}{\underset{|}{C}} = CH_2$
(d) $H_2C = CH - \underset{\displaystyle Cl}{\underset{|}{C}} = CH_2$ and $H_2C = CH - CH = CH_2$

83. Which of the following structures represents neoprene polymer?
(a) $\left(CH_2 - \underset{\displaystyle Cl}{\underset{|}{C}} = CH - CH_2\right)_n$
(b) $\left(CH_2 - \underset{\displaystyle CN}{\underset{|}{CH}}\right)_n$
(c) $\left(CH_2 - \underset{\displaystyle Cl}{\underset{|}{CH}}\right)_n$
(d) $\left(\underset{\displaystyle C_6H_5}{\underset{|}{CH}} - CH_2\right)_n$

84. Which of the following is not a copolymer?
(a) Buna–S (b) Baketite
(c) Neoprene (d) Dacron

85. In the manufacture of tyre rubber, the percentage of sulphur used as a crosslinking agent is
(a) 2% (b) 5%
(c) 10% (d) 0.5%

86. Which of the following polymer is formed on reaction of 1,3–butadiene and acrylonitrile?
(a) Buna–S (b) Buna – N
(c) Neoprene (d) Dacron

87. Which of the following monomers form biodegradable polymers?
(a) 3-hydroxybutanoic acid + 3-hydroxypentanoic acid
(b) Glycine + amino caproic acid
(c) Ethylene glycol + phthalic acid
(d) both (a) and (b)

88. The polymer which undergoes environment degradation by microoganism is known as
(a) chain-growth polymer
(b) chain step polymer
(c) biodegradable polymer
(d) non-biodegradable polymer

89. Generally, molecular mass of a polymer is over
(a) 100 (b) 500
(c) 1,000 (d) 10,000

90. For natural polymers PDI is generally
(a) 0 (b) 1
(c) 100 (d) 1000

STATEMENT TYPE QUESTIONS

91. Which of the following statement(s) is/are correct?
(i) Macromolecules have high molecular mass of order $10^3 - 10^7$u.
(ii) Monomeric units are joined together by ionic or covalent bond.
(a) Only (i) (b) Only (ii)
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

92. Consider the following statements.
(i) Polystyrene is a homopolymer whereas Buna–N is a copolymer.
(ii) Condensation polymers can be obtained by condensation between two similar bi–functional monomeric units.
(iii) Elastomers are the polymers in which the polymeric chains are held together by the weakest intermolecular forces.
(iv) Buna–S and Buna–N consist of close packing of chains which impart them crystalline nature.
Which of the following is the correct code for the statements above?
(a) TTFF (b) TFTF
(c) FTFT (d) TFFT

93. Two condensation polymers are made
(1) ethylene diamine + ethane–1, 2– dicarboxylic acid
(2) trimethylenediamine + ethane–1, 2– dicarboxylic acid
if both polymers of same molecular weight are obtained then which of the following statements is/are correct ?
(i) Polymer (1) is found to melt at lower temperature.
(ii) Polymer (2) is found to melt at lower temperature.
(iii) H-bonding is major factor.
(a) (i), (ii) and (iii) (b) Only (ii)
(c) (i) and (iii) (d) (ii) and (iii)

94. Which of the following statements are correct?

(i) A polyamide nylon 6,6 prepared by the condensation polymerisation of hexamethylene diamine with adipic acid is used in the manufacture of tyre cords.

(ii) Terylene is crease resistant and is blended with cotton and wool fibres for various applications.

(iii) Condensation reaction of phenol and formaldehyde to form novolac can be catalysed either by acid or base.

(iv) Melamine formaldehyde polymer is mainly used in the manufacture of electrical switches

(a) (i), (ii) and (iii) (b) (ii), (iii) and (iv)

(c) (iii) and (iv) (d) (ii) and (iii)

95. Read the following statements.

(i) Rubber latex is a colloidal dispersion of rubber in water.

(ii) Natural rubber is a cis –1, 4–polyisoprene having elastic properties due to coiled structure and weak van der Waal's forces.

(iii) Vulcanisation of natural rubber with sulphur and an appropriate additive is carried out above 415K.

(iv) In the manufacture of tyre rubber, 5% of sulphur is used as a cross-linking agent.

(v) Synthetic rubbers are homopolymers.

Which of the following is the correct code for the statements above?

(a) FFTFT (b) TTFTF

(c) TTFFF (d) FFTTF

96. Which of the following statements are correct?

(i) Buna–N being resistant to the action of petrol, lubricating oil and organic solvents is used in making oil seals.

(ii) Biodegradable polymers are manufactured because of low chemical resistance, strength and durability of conventional polymers.

(iii) PHBV is a copolymer used in the manufacture of orthopaedic devices.

(iv) Nylon 2–nylon 6 is a biodegradable polymer.

(a) (i), (ii) and (iii) (b) (ii), (iii) and (iv)

(c) (i), (iii) and (iv) (d) (i) and (iv)

MATCHING TYPE QUESTIONS

97. Match the columns.

	Column-I		Column-II
(A)	Linear polymer	(p)	Melamine
(B)	Semisynthetic polymer	(q)	Polyvinyl chloride
(C)	Branched chain polymer	(r)	LDPE
(D)	Network polymer	(s)	Cellulose nitrate

(a) A – (s), B – (q), C – (r), D – (p)

(b) A – (q), B – (s), C – (r), D – (p)

(c) A – (q), B – (r), C – (s), D – (p)

(d) A – (q), B – (s), C – (p), D – (r)

98. Match the columns.

	Column-I		Column-II
(A)	Highly branched chemically inert polymer used in the insulation of electric wires.	(p)	Teflon
(B)	Linear polymer prepared in presence of $Al(C_2H_5)_3$ and $TiCl_4$.	(q)	Polyacrylonitrile
(C)	Corrosion resistant polymer used in manufacture of non–stick surface coated utensils.	(r)	HDPE
(D)	Addition polymer used as a substitute for wool.	(s)	LDPE

(a) A–(s), B–(r), C–(q), D–(p)

(b) A–(s), B–(p), C–(r), D–(q)

(c) A–(s), B–(r), C–(p), D–(q)

(d) A–(r), B–(s), C–(p), D–(q)

99. Match Column-I (Monomer) with Colum-II (Polymer) and select the correct answer using the codes given below the lists:

	Column-I		Column-II
(A)	Hexamethylenediamine	(p)	Bakelite
(B)	Phenol	(q)	Dacron
(C)	Phthalic acid	(r)	Glyptal
(D)	Terephthalic acid	(s)	Melamine
		(t)	Nylon

(a) A – (t), B – (p), C – (q), D – (r)

(b) A – (t), B – (p), C – (r), D – (q)

(c) A – (s), B – (r), C – (p), D – (q)

(d) A – (s), B – (r), C – (q), D – (p)

100. Match the columns

	Column-I		Column-II
(A)	Polyester of glycol and phtalic acid	(p)	Novalac
(B)	Copolymer of 1, 3-butadiene and styrene	(q)	Glyptal
(C)	Phenol and formaldehyde resin	(r)	Buna-S
(E)	Polyester of glycol and terephthalic acid	(s)	Buna-N
(F)	Copolymer of 1, 3-butadiene and acrylonitrile	(t)	Dacron

(a) A – (q), B – (s), C – (p), D – (t), E – (r)

(b) A – (q), B – (r), C – (p), D – (t), E – (s)

(c) A – (r), B – (p), C – (t), D – (s), E – (q)

(d) A – (p), B – (s), C – (q), D – (t), E – (r)

101. Match the polymers given in Column-I with their chemical names given in Column-II

Column-I	Column-II
(A) Nylon 6	(p) Polyvinyl chloride
(B) PVC	(q) Polyacrylonitrile
(C) Acralin	(r) Polycaprolactum
(D) Natural rubber	(s) Low density polythene
(E) LDP	(t) cis-polyisoprene

(a) A – (r), B – (p), C – (q), D – (t), E – (s)
(b) A – (s), B – (q), C – (t), D – (r), E – (p)
(c) A – (t), B – (s), C – (p), D – (q), E – (r)
(d) A – (s), B – (t), C – (r), D – (q), E – (p)

102. Match the columns

Column-I (Polymers)	Column-II (Uses)
(A) Nylon 6,6	(p) Fabrics and ropes
(B) Nylon 6	(q) Electrical switches
(C) Dacron	(r) Bristles for brushes
(D) Bakelite	(s) As glass reinforcing materials in safety helmets.

(a) A – (q), B – (s), C – (r), D – (p)
(b) A – (r), B – (q), C – (s), D – (p)
(c) A – (r), B – (p), C – (s), D – (q)
(d) A – (r), B – (p), C – (q), D – (s)

103. Match the columns

Column-I	Column-II
(A) Polymer of styrene	(p) used in making handles of utensils and computer discs
(B) Polymer of ethylene glycol and phtalic acid	(q) used as an insulator
(C) Polymer of phenol and formaldehyde	(r) used in making paints and lacquers.
(D) Polymer of vinyl chloride	(s) used in manufacture of rain coats and flooring.

(a) A – (q), B – (r), C– (p), D – (s)
(b) A – (r), B – (q), C– (p), D – (s)
(c) A – (q), B – (p), C– (r), D – (s)
(d) A – (q), B – (r), C– (s), D – (p)

ASSERTION-REASON TYPE QUESTIONS

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
(c) Assertion is correct, reason is incorrect
(d) Assertion is incorrect, reason is correct.

104. Assertion : Olefinic monomers undergo addition polymerisation.
Reason : Polymerisation of vinylchloride is initiated by peroxides/ persulphates.

105. Assertion : Teflon has high thermal stability and chemical inertness.
Reason : Teflon is a thermoplastic.

106. Assertion : Bakelite is a thermosetting polymer.
Reason : Bakelite can be melted again and again without any change.

107. Assertion : In vulcanisation of rubber, sulphur cross links are introduced.
Reason : Vulcanisation is a free radical initiated chain reaction.

108. Assertion : The time of vulcanisation and temperature is increased by adding accelerators.
Reason : By vulcanising, a material of high tensile strength can be obtained.

109. Assertion : Most of the Synthetic polymers are not biodegradable.
Reason : Polymerisation process induces toxic character in organic molecules.

CRITICAL THINKING TYPE QUESTIONS

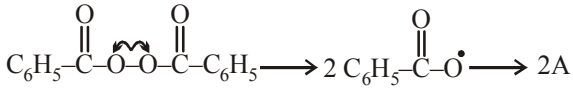
110. The polymer containing strong intermolecular forces *e.g.* hydrogen bonding, is
(a) teflon (b) nylon 6, 6
(c) polystyrene (d) natural rubber

111. Among cellulose, poly (vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is
(a) nylon (b) poly (vinyl chloride)
(c) cellulose (d) natural rubber

112. Which one of the following polymers is prepared by condensation polymerisation?
(a) Teflon (b) Natural rubber
(c) Styrene (d) Nylon-66

113. When condensation product of hexamethylenediamine and adipic acid is heated to 525K in an atmosphere of nitrogen for about 4-5 hours, the product obtained is
(a) solid polymer of nylon 66
(b) liquid polymer of nylon 66
(c) gaseous polymer of nylon 66
(d) liquid polymer of nylon 6

114. Identify A, B and C in the following sequence of reactions



$A + CH_2 = CH_2 \longrightarrow B$

$B + nCH_2 = CH_2 \longrightarrow C$

$C + C \longrightarrow C_6H_5–(CH_2–CH_2)_n—CH_2–CH_2–CH_2$

$–(CH_2–CH_2)_n–C_6H_5$

(a) $A = \dot{C}_6H_5$, $B = C_6H_5 – CH_2 – \dot{C}H_2$ and

$C = \dot{C}_6H_5 –(CH_2 – CH_2)_n—CH_2 – \dot{C}H_2$.

(b) $A = C_6H_5\,\dot{C}O$, $B = C_6H_5 – CH_2 – \dot{C}H_2$ and

$C = C_6H_5 –(CH_2–CH_2)_n—CH_2 – \dot{C}H_2$

(c) $A = \dot{C}_6H_5$, $B = C_6H_5 – \dot{C}H – CH_3$ and

$C = C_6H_5—(CH_2 –CH_2)_n—CH_2\dot{C}H_2$

(d) $A = \dot{C}_6H_5$, $B = C_6H_5 –CH_2 – \dot{C}H_2$ and

$C = C_6H_5 –(CH_2 – CH_2)_n—C_6H_5$

115. In which of the following the formation of radical was found to be more stable; the formation of radical of (acrylonitrile) or $[CH_2 – CH_2]_n$ (ethene).

(a) Both are equally stable (b) Acrylonitrile.

(c) Ethene (d) Cannot say

116. Which one of the following monomers gives the polymer neoprene on polymerization ?

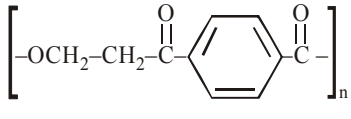
(a) $CF_2 = CF_2$

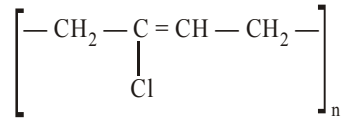
(b) $CH_2 = CHCl$

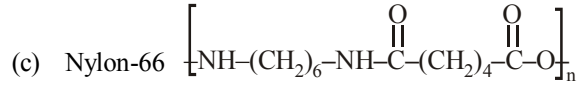
(c) $CCl_2 = CCl_2$

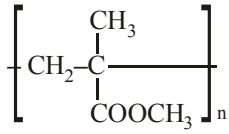
(d) $CH_2 = \underset{\displaystyle Cl}{\underset{|}{C}} — CH = CH_2$

117. Which of the following is not correctly matched?

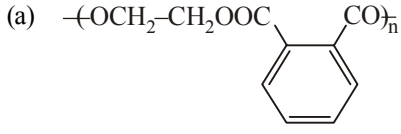
(a) Terylene 

(b) Neoprene 

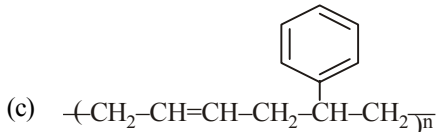
(c) Nylon-66 

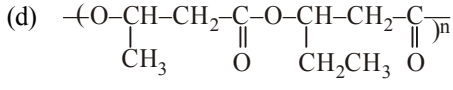
(d) PMMA 

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

(a) 

(b) 

(c) 

(d) 

119. Arrange the following in increasing order of their melting point. Nylon 2,2 (1); Nylon 2,4 (2), Nylon 2,6 (3), Nylon 2,10(4)

(a) 1, 2, 3, 4 (b) 3, 4, 2, 1

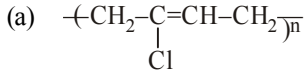
(c) 2, 1, 3, 4 (d) 4, 3, 2, 1

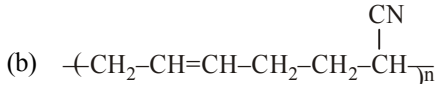
120. Which of the following rubber is not a polydiene?

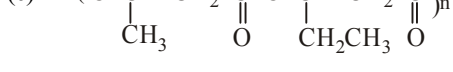
(a) Polyisoprene (b) Polychloroprene

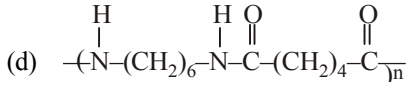
(c) Thiokol rubber (d) Nitrile rubber

121. Which of the following polymer is biodegradable?

(a) 

(b) 

(c) 

(d) 

122. The mass average molecular mass & number average molecular mass of a polymer are 40,000 and 30,000 respectively. The polydispersity index of polymer will be

(a) < 1 (b) > 1

(c) 1 (d) 0

HINTS AND SOLUTIONS

FACT/DEFINITION TYPE QUESTIONS

1. (d)

2. (d) All these are natural polymers and exist in nature.

3. (c) ATP is a monomer molecule.

4. (a) It is present in the cell wall of plant cell.

5. (b) Since proteins, cellulose and RNA control various activities of plants and animals, they are called biopolymers.

6. (d) Rayon is a manufactured from regenerated cellulosic fiber. Rayon is produced from naturally occurring polymers and therefore it is not a truly synthetic fiber, nor is it a natural fiber. It is known by the names *viscose rayon* and *artificial silk* in the textile industry. So, option **(d)** is the correct choice.

7. (c) Protein is a natural polymer of amino acids.

8. (b)

9. (b) Polymers are substances of high molecular weight (usually more than a few thousand) formed by the union of small molecular weight substances by covalent bonds.

10. (d) Cellulose acetate also known as rayon and cellulose nitrate are semisynthetic polymers.

11. (a) **12. (a)**

13. (a) Polymerisation starts either by condensation or addition reactions between monomers. Condensation polymers are formed by the combination of monomers with the elimination of simple molecules. Whereas the addition polymers are formed by the addition together of the molecules of the monomer or monomers to form a large molecule without elimination of any thing.

14. (d) **15. (a)** **16. (d)** **17. (c)**

18. (b) Elastomers are the polymers having very weak intermolecular forces of attraction between the polymer chain. The weak forces permit the polymer to be streched.

19. (b) Those polymers in which process of heat softening and cooling can be repeated as many times as desired. Example : polystyrene PVC, teflon, etc.

20. (c) Bakelite is a thermosetting polymer. On heating it is infusible and cannot be remoulded.

21. (b)

22. (d) These are characteristics of thermosets.

23. (d) All these are characteristics of elastomers.

24. (d) Thermosetting polymers have strongest molecular forces. These are crosslinked polymers.

25. (b) Thermosetting plastics have three dimensional cross linked structure.

26. (d) Silk is protein fibre. Dacron is polyester fibre and Nylon-66 is polyamide fibre.

27. (d) All the given statements about fibres are correct.

28. (d) Both polyesters and polyamides are examples of fibres.

29. (b) Polystyrene and polyethylene belong to the category of thermoplastic polymers which are capable of repeatedly softening on heating and harden on cooling.

30. (d) Vinyl chloride, butadiene and styrene being unsaturated undergoes addition polymerization.

31. (b) **32. (a)** **33. (c)**

34. (a) Ethene on free radical polymerisation gives low density polythene.

35. (b) Monomer of teflon is to Tetrafluoro ethylene C_2F_4.

36. (d) Acrylonitrile is the monomer used in the preparation of orlon.

37. (d) Orlon is a trade name of polyacrylonitrile

38. (b) High density polythene is used for manufacturing of buckets, dustbins, pipes etc.

39. (b) High density polythene is formed when addition polymerisation of ethene takes place in a hydrocarbon solvent in presence of catalyst such as ziegler-natta catalyst.

40. (b) Nylon-66 is an example of first synthetic fibres produced from the simple molecules. It is prepared by condensation polymer-isation of adipic acid and haxamethylene diamine.

41. (a) Melamine plastic crockery is a copolymer of HCHO and Melamine.

42. (d) **43. (a)**

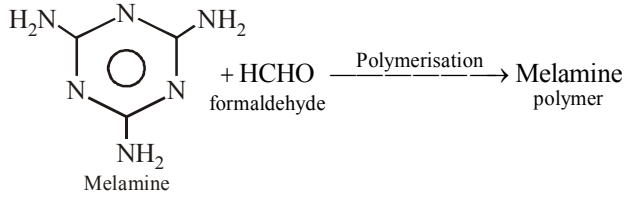
44. (b)

$$\underset{\text{adipic acid}}{nHOOC(CH_2)_4COOH} + \underset{\text{Hexamethylene diamine}}{nH_2N(CH_2)_6NH_2}$$

$$\xrightarrow[\text{Polymerisation}]{525K} \underset{\text{Nylon 6, 6}}{[-C-(CH_2)_4-C-NH-(CH_2)_6-NH-]_n}$$

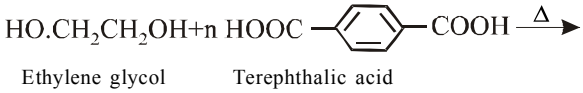
45. (b)

46. (d) The unbreakable plastic household crockery is made from copolymer of formaldehyde (HCHO) and melamine.

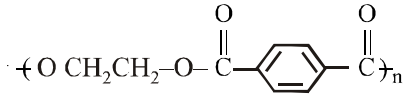


47. (d) Nylon tyre cord is made from high tenacity continuous filament yarn by twisting and plying.

48. (a) Polyesters are condensation polymers of a dibasic acid and a diol. e.g., Terylene

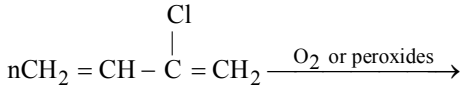


Ethylene glycol Terephthalic acid

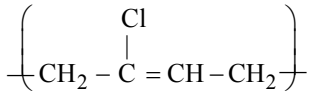


Terylene

49. (d) Neoprene is an addition polymer of isoprene.

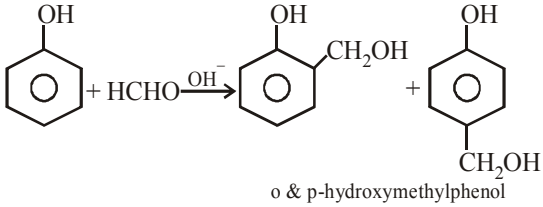


Chloroprene

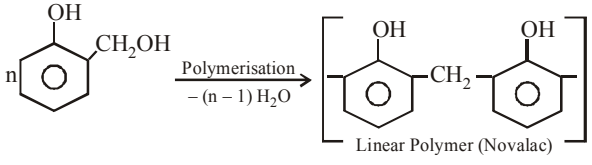


Neoprene

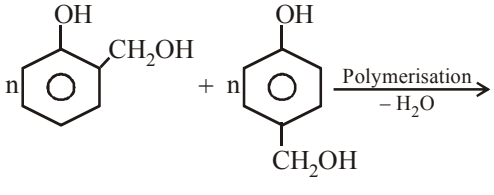
50. (d) Phenol and formaldehyde undergo condensation polymerisation under two different conditions to give a cross linked polymer called bakelite.

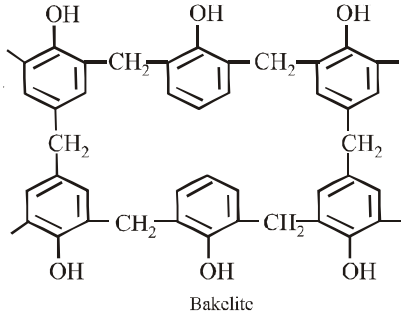


o & p-hydroxymethylphenol
(intermediate)



Linear Polymer (Novalac)



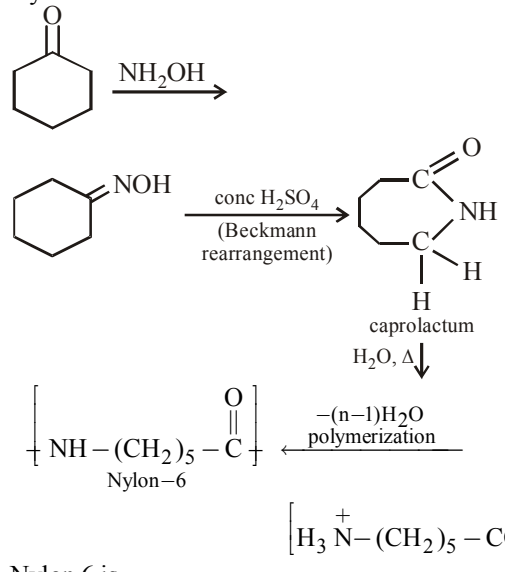


Bakelite

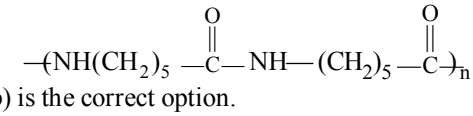
51. (b) Nylon 6, 6 has amide linkage capable of forming hydrogen bonding.

52. (b) Nylon is a polyamide polymer.

53. (d) Nylon–6 can be manufactured from



54. (b) Nylon 6 is

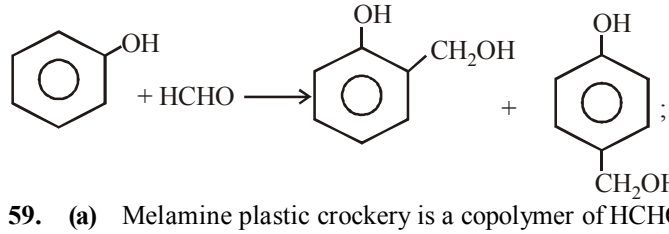


Hence (b) is the correct option.

55. (b) Nylon is a polyamide fibre. It is prepared by the condensation polymerisation of adipic acid ($HOOC.(CH_2)_4COOH$) and hexamethylene diamine ($H_2N.(CH_2)_6.NH_2$).

56. (c) **57. (b)**

58. (a)



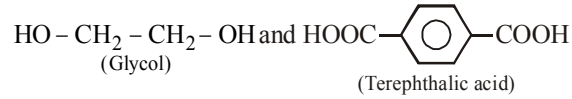
59. (a) Melamine plastic crockery is a copolymer of HCHO and Melamine.

60. (a) Bakelite is used for making phonograph records.

61. (b) Novolac is a linear polymer.

62. (a) Dacron is a polyester and is the condensation polymer of ethylene glycol and terephthalic acid. It is crease resistant

63. (c) Terylene is made from glycol and Terephthalic acid



(Glycol) (Terephthalic acid)

64. (d) **65. (a)** **66. (d)**

67. (d) Butadiene – styrene copolymer is used for the manufacture of autotyres, floortiles, footwear components, cable insulation etc.

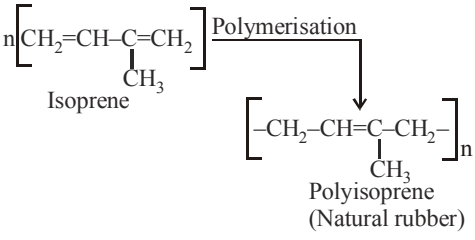
68. (a) This is definition of homopolymer.

69. (a) Butyl rubber is a copolymer of isobutylene and isoprene.

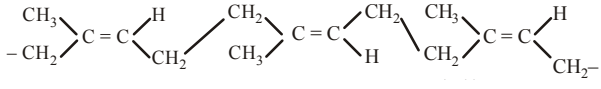
70. **(d)** Neoprene is a homopolymer of 2-chloro-buta-1, 3-diene or chloroprene.

71. **(b)** It is the definition of copolymerisation.

72. **(b)**



73. **(b)**



Natural rubber

(All cis configuration)

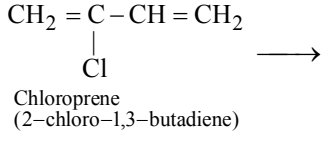
All statements except (b) are correct

74. **(b)** Natural rubber is a linear 1, 4-addition polymer of isoprene (2-methyl-1, 3-butadiene).

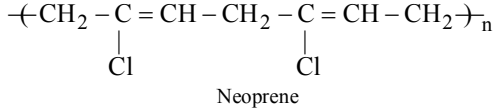
75. **(d)** **76.** **(b)** **77.** **(b)**

78. **(c)** Rubber is a polymer of isoprene. Its chemical formula is $(C_5H_8)_n$.

79. **(a)** Neoprene is a synthetic polymer that resembles natural rubber. Neoprene is a polymer of chloroprene which polymerises 700 times faster than the isoprene (monomer of natural rubber) and no specific catalyst is needed for this purpose.

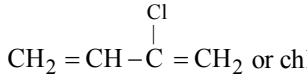


Chloroprene
(2–chloro–1,3–butadiene)



Neoprene

80. **(d)** Synthetic rubber (neoprene) is a polymer of



or chloroprene.

81. **(a)**

82. **(b)** Buna – N is a copolymer of butadiene (CH_2=CH–CH=CH_2) and acrylonitrile (CH_2 = CHCN).

83. **(a)** Neoprene is a polymer of chloroprene (2 – chloro – 1, 3 – butadiene).

84. **(c)** Neoprene is a homopolymer of chloroprene.

85. **(b)** 5% of sulphur is used as a crosslinking agent in the manufacture of tyre rubber.

86. **(b)** Buna – N is obtained by copolymerisation of 1, 3–butadiene and acrylonitrile.

87. **(d)** **88.** **(c)** **89.** **(d)** **90.** **(b)**

STATEMENT TYPE QUESTIONS

91. **(a)** Monomeric units in polymers are joined together by covalent bonds only.

92. **(b)** Condensation polymers are formed by repeated condensation reaction between two different bi-functional or tri–functional monomeric units.
Buna–S and Buna–N being elastomeric consists of polymeric chains held together by weak intermolecular forces thus they are elastic in nature.

93. **(d)** Number of hydrogen bonds is greater in polymer (1) than in (2) as the density of amide bond is greater in (1) therefore the chain links to each other strongly in (1) than in (2) hence (1) melts at higher temperature.

94. **(d)** Nylon–6 is used in the manufacturing of tyre cords not nylon–6,6 this is used in making sheets, bristles for brushes and in textile industry. Melamine – formaldehyde polymer is used in the manufacture of unbreakable crockery.

95. **(b)** Vulcanisation of natural rubber with sulphur and an appropriate additive is carried out within temperature range of 373K to 415K. Synthetic rubbers are either homopolymersof 1, 3– butadiene derivatives or copolymers of 1, 3–butadiene or its derivatives with another unsaturated monomer.

96. **(c)** Biodegradable polymers are manufactured because conventional polymers are quite resistant to the environmental degradation which leads to accumulation of polymeric solid waste materials causing acute environmental problems.

MATCHING TYPE QUESTIONS

97. **(b)** A – (q), B – (s), C – (r), D – (p)

98. **(c)** A – (s), B – (r), C – (p), D – (q)

99. **(b)** A – (t), B – (p), C – (r), D – (q)

100. **(b)** A – (q), B – (r), C – (p), D – (t), E – (s)

101. **(a)** A – (r), B – (p), C – (q), D – (t), E – (s)

102. **(c)** A – (r), B – (p), C – (s), D – (q)

103. **(a)**
(A) Polystyrene is used as insulator.
(B) Glyptal a polymer of ethylene glycol and phthali acid is used in manufacture of paints and lacquers.
(C) Bakelite, a polymer of phenol & formal dehyde is used for making electrical switches, handles of utensils and computer disc's.
(D) PVC, a polymer of vinyl chloride is used in manufacture of raincoat and flooring.

ASSERTION-REASON TYPE QUESTIONS

104. **(a)**

105. **(b)** Due to the presence of strong C–F bonds, teflon has high thermal stability and chemical inertness.

106. **(c)** Bakelite can be heated only once.

107. **(b)** Vulcanisation is a process of treating natural rubber with sulphur or some compounds of sulphur under heat so as to modify its properties. This cross-linking give mechanical strength to the rubber.

108. (d) The time of vulcanisation is reduced by adding accelerators and activators.

109. (d)

CRITICAL THINKING TYPE QUESTIONS

110. (b) Nylon 6, 6 has amide linkage capable of forming hydrogen bonding.

111. (d) Nylon and cellulose, both have intermolecular hydrogen bonding, polyvinyl chloride has dipole-dipole interactions, while natural rubber has van der Waal forces which are weakest.

112. (d) Copolymer of adipic acid (6C) and hexamethylene diamine (6C).

$$n\,\underset{\text{Adipic acid}}{HOOC(CH_2)_4COOH} + n\underset{\text{Hexamethylene diamine}}{H_2N(CH_2)_6NH_2} \rightarrow$$

$$\underset{\text{Nylon 66}}{\left(\overset{O}{\overset{\|}{C}} - (CH_2)_4 - \overset{O}{\overset{\|}{C}} - NH - (CH_2)_6 - NH \right)_n}$$

It has high tenacity and elasticity. It is resistant to abrasion and not affected by sea water. It is used for reinforcement of rubber tyres, manufacture of parachute, safety belts, carpets and fabrics.

113. (b) The condensation polymerisation of hexamethylene diamine and adipic acid is done in solution form by interface technique. In this liquid nylon polymer is obtained.

$$n.H_2N - (CH_2)_6 - NH_2 +$$

$$+ nHOOC - (CH_2)_4 - COOH \xrightarrow[-nH_2O]{\text{Polymerisation}}$$

$$\underset{\text{Nylon}}{[-HN - (CH_2)_6 - NHCO - (CH_2)_4 - CO-]_n}$$

114. (a) $\dot{C}_6H_5 - \overset{O}{\overset{\|}{C}} - O - O - \overset{O}{\overset{\|}{C}} - C_6H_5 \longrightarrow 2C_6H_5 - \overset{O}{\overset{\|}{C}} - \dot{O}$

$$\longrightarrow \underset{\text{(A)}}{2\dot{C}_6H_5}$$

Phenyl radical

$$\underset{(A)}{\dot{C}_6H_5} + CH_2 = CH_2 \longrightarrow \underset{(B)}{C_6H_5 - CH_2 - CH_2 - CH_2 - \dot{C}H_2}$$

$$\underset{(B)}{C_6H_5 - CH_2 - CH_2 - CH_2 - \dot{C}H_2} + nCH_2 = CH_2 \longrightarrow$$

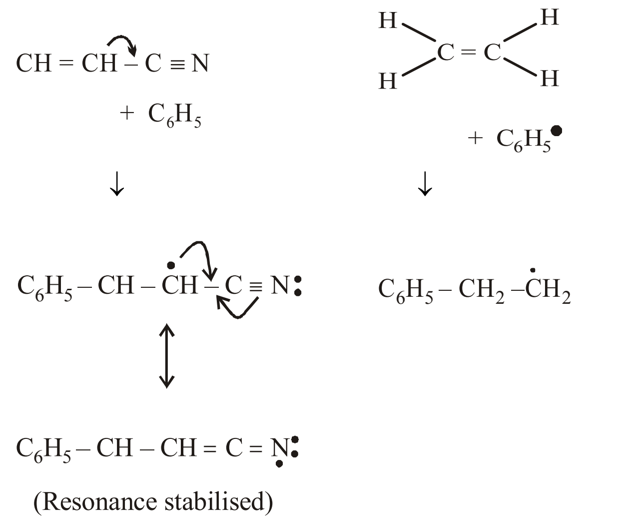
$$\underset{(C)}{C_6H_5 - (CH_2 - CH_2)_n CH_2 - \dot{C}H_2}.$$

$$C_6H_5 - (CH_2 - CH_2)_n - CH_2 - \dot{C}H_2 + C_6H_5 - (CH_2 - CH_2)_n - CH_2\dot{C}H_2$$

$$\longrightarrow C_6H_5 - (CH_2 - CH_2)_n - CH_2 - CH_2 - CH_2$$

$$-(CH_2 - CH_2)_n - C_6H_5$$

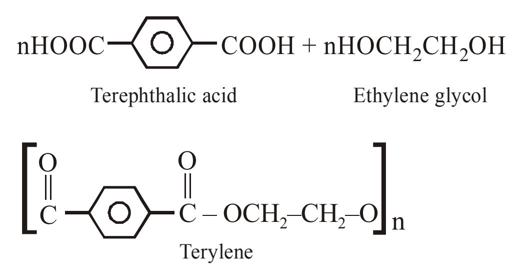
115. (b) Considering the resonance structure, the radical of acrylonitrile is found to be more stable.



116. (d) $n\underset{\text{Chloroprene}}{CH_2 = CH - \overset{Cl}{\overset{|}{C}} = CH_2} \xrightarrow{O_2 \text{ or peroxides}}$

$$\underset{\text{Neoprene}}{(-CH_2 - CH = \overset{Cl}{\overset{|}{C}} - CH_2-)_n}$$

117. (a) Terylene is prepared by condensing terephthalic acid and ethylene glycol



118. (a)

119. (d) As the amide density along the chain increases the melting point increases.

120. (c) Thiokol is polymer of CH_2ClCH_2Cl and sodium polysulphide Na–S–S–Na and thus, not polydiene rubber.

121. (d)

122. (b) Average number molecular weight $\overline{M_n} = 30{,}000$

Average mass molecular weight $\overline{M_w} = 40{,}000$

$$\text{Polydispersity index (PDI)} = \frac{\overline{M_w}}{\overline{M_n}} = \frac{40{,}000}{30{,}000} = 1.33$$