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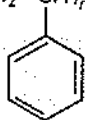
Polymers

Previous Years' Examination Questions


Practice the Real Questions

1 Mark Questions

1. Is $\text{-(CH}_2\text{-CH)}_n\text{-}$ a homopolymer or a copolymer?



[All India 2013]

2. Give one example of a condensation polymer. [All India 2013]
3. Is $\text{-(CH}_2\text{-CH)}_n\text{-}$ a homopolymer or a copolymer?  [All India 2013]
4. Define the term, 'homopolymerisation' giving an example. [Delhi 2012]

Polymers

5. Draw the structure of the monomer for the following polymer
Polypropene [Delhi 2012]
6. What are biodegradable polymers?
[Delhi 2011]
7. Write the name of monomers of neoprene.
[All India 2011]
8. In nylon-6,6 what does the designation '6,6' mean?
[All India 2011, 2010, 2009; Delhi 2009]
9. Write the structure and one use of each of the following polymers [All India 2010]
 - (i) PVC
 - (ii) Urea-formaldehyde resin
 - (iii) Bakelite
10. Write the structure and one use of urea formaldehyde resin. [All India 2010C]
11. Write the structure of the monomeric unit of nylon-6. [Delhi 2010]
12. What is meant by copolymerisation?
[All India 2010]
13. Give an example of elastomers.
[Delhi 2009]
14. Write the distinguishing feature between homopolymers and copolymers.
[Delhi 2010, 2008C; Foreign 2008]
15. Is $[\text{CH}_2-\text{CH}-(\text{C}_6\text{H}_5)]_n$ a homopolymer or a copolymer, why? [All India 2008]
16. What is the repeating structural unit in polythene polymer?
[All India 2011; Delhi 2009; Foreign 2008]
17. Write the names of monomers of PMMA and state one use of it. [Delhi 2006C, 2006]
18. Write the monomers of buna-N.
[All India 2006]
20. Draw the structure of the monomer for each of the following polymers:
 - (i) Nylon-6
 - (ii) Polypropene [Delhi 2012]
21. Write the structure of the monomer of each of the following polymers:
 - (i) Nylon-6
 - (ii) Teflon
 - (iii) Neoprene [All India 2007]
22. Name the subgroups into which polymers are classified on the basis of magnitude of intermolecular forces.
[Delhi 2011; Foreign 2010; All India 2009]
23. Mention two important uses of each of the following.
 - (i) Bakelite
 - (ii) Nylon-6 [Delhi 2011; All India 2010]
24. Mention two important uses of each.
 - (i) Nylon-66
 - (ii) PVC [Foreign 2011; Delhi 2007]
25. Write the structure of repeating monomeric units of
 - (i) Dacron
 - (ii) Neoprene
 - (iii) Polyvinyl chloride
 - (iv) Teflon [Foreign 2010, 2009; Delhi 2010, 2010C; All India 2010;]
26. What is the repeating unit in the condensation polymer obtained by combining $\text{HO}_2\text{CCH}_2\text{CH}_2\text{CO}_2\text{H}$ (succinic acid) and $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ (ethylene diamine)? [Delhi 2009]
27. What is step growth polymerisation? Explain the steps involved in this process.
[All India 2008C]
28. What is the difference between elastomers and fibres? Give one example of each.
[All India 2008C]
29. Distinguish between homopolymers and copolymers and give an example of each class. [All India 2008; Foreign 2008]
30. (i) How does vulcanisation change the character of natural rubber?
(ii) Why are the numbers 6,6 and 6 put in the names of nylon-6,6 and nylon-6? [Delhi 2006]

2 Marks Questions

19. Define thermoplastic and thermosetting polymers. Give one example of each.
[All India 2013]

OR

What is a biodegradable polymer? Give an example of a biodegradable aliphatic polyester.

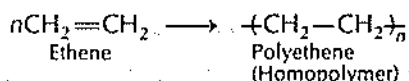
3 Marks Questions

31. Write the names and structures of the monomers of the following polymers
 (i) Buna-S
 (ii) Neoprene
 (iii) Nylon-66 [Delhi 2013]
32. Write the names and structures of the monomers of the following polymers
 (i) Polystyrene (ii) Dacron
 (iii) Teflon [Delhi 2013]
33. Write the names and structures of the monomers of the following polymers.
 (i) Bakelite (ii) Nylon-6
 (iii) Polythene [Delhi 2013]
34. Differentiate between thermoplastic and thermosetting polymers. Give one example of each.
 [All India 2012, 2008; Delhi 2010, Foreign 2007]
35. Explain the following terms giving a suitable examples for each
 (i) Elastomers
 (ii) Condensation polymers
 (iii) Addition polymers. [All India 2012]
36. Distinguish between addition polymers and condensation polymers. Classify the following into addition and condensation polymers.
 (i) Polyethene (ii) PTFE
 (iii) Polybutadiene (iv) Bakelite
 [All India 2011C; Foreign 2009, 2007]
37. Write the name and structures of monomers and of the following polymers.
 (i) Buna-S (ii) Dacron
 (iii) Glyptal [Delhi 2011C, 2008; All India 2011]
38. Write chemical equations for the synthesis of
 (i) Terylene
 (ii) Neoprene
 (iii) Teflon [Delhi 2011C; All India 2006]
39. (i) What does designation 66 in nylon-66 polymer mean?
 (ii) Which polymer is obtained when free radical polymerisation of chloroprene occurs? Write the structure of the polymers thus obtained. [Foreign 2011]
40. What are addition polymers? How are the two types of addition polymers different from each other? Give one example of each type. [Foreign 2011]
41. Identify the four groups into which the polymers are classified on the basis of the magnitude of intermolecular forces present in them. To which group or groups do polythene and bakelite belong? [Foreign 2010]
42. Give one example each of
 (i) addition polymers
 (ii) condensation polymers
 (iii) copolymers [Delhi 2010]
43. Write chemical equation for the synthesis of
 (i) Nylon-6
 (ii) Nylon-66
 (iii) Polythene [All India 2009C, 2006]
44. What are biodegradable polymers? Give an example of such a polymer and mention its uses. [Delhi 2009C]
45. What is the primary structure feature necessary for a molecule to make it useful in a condensation polymerisation reactions? [All India 2009]
46. Define the term 'polymerisation'. [All India 2008]
47. Draw the structures of monomers of the following polymers.
 (i) Polythene
 (ii) PVC
 (iii) Teflon [All India 2007]

Step-by-Step Solutions

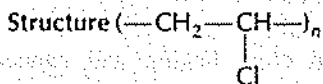
- It is a homopolymer because single type of monomer unit, i.e., $C_6H_5CH=CH_2$ undergo polymerisation. (1)
- Nylon-66 is an example of condensation polymer because it is the result of condensation reaction between adipic acid and hexamethylene diamine. (1)
- It is homopolymer because contains single type of monomer. (1)
- The polymers formed by the polymerisation of single monomeric species are known as homopolymers and the process is known as homopolymerisation. (1)

e.g., formation of polyethene



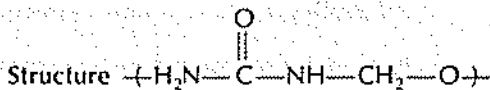
- $CH_2=CH-CH_3$ (Propene) is the monomer for polypropene. (1)
- Biodegradable polymers are those polymers which degrade in the environment and do not cause any environmental pollution. (1)
- 2-chloro-1,3-butadiene chloroprene is the monomer of neoprene. (1)
- The monomers of nylon-66 i.e., hexamethylene diamine and adipic acid both are 6 carbon compounds, so it is called nylon-66. (1)

9. (i) PVC



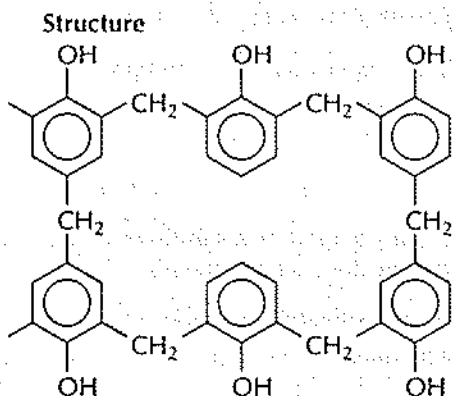
Use in making pipes, raincoats.

(ii) Urea formaldehyde resin



Use in making unbreakable crockery.

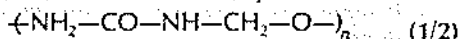
(iii) Bakelite



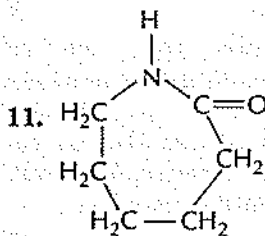
(1)

Use in making electrical switches and switch boards.

10. Structure of urea-formaldehyde resin is



It is used for making unbreakable cups. (1/2)



Caprolactam is the monomeric unit of nylon-6. (1)

12. The polymerisation in which repeating units are derived from two types of monomers is called copolymerisation. e.g., nylon-66 is a copolymer of hexamethylene diamine and adipic acid. (1)

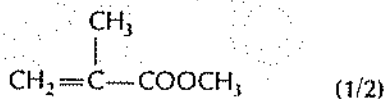
13. Rubber, Buna-S, Buna-N. (1)

14. Homopolymers are formed by the polymerisation of single monomeric species e.g., polythene while copolymers are formed by the polymerisation of two different monomers e.g., buna-S. (1)

15. It is a homopolymer and the monomer from which it is obtained is styrene $C_6H_5-CH=CH_2$. (1)

16. Ethene, $CH_2=CH_2$. (1)

17. The monomer of PMMA is methyl methacrylate.



PMMA is used as a substitute of glass and in making decorative materials. (1/2)

18. Buta-1,3-diene ($CH_2=CH-CH=CH_2$) and acrylonitrile ($CH_2=CH-CN$) are the monomers of



buna-N. (1)

19. Thermoplastic polymers These are linear polymers and can be repeated softened on heating and hardened on cooling, therefore, these can be used again and again without change in their chemical composition. For example; polythene. (1)

Thermosetting polymers These are the polymer which when heated in a mould, undergo a permanent change in their chemical composition to give a hard mass. Thus they can be heated only once and then set into a solid which cannot be remelted or reworked.

For example, bakelite (1)

Or

Biodegradable polymer The natural polymer, which disintegrates by itself or by microorganisms with in certain period of time is called biodegradable polymer. e.g., PHBV (poly β -hydroxy butyrate co- β -hydroxy valerate)

(1 + 1 = 2)

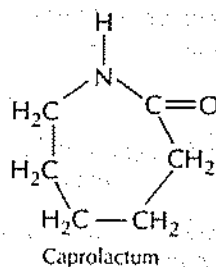
20. (i) $[NH-(CH_2)_5-CO]$, which is derived from caprolactum. (1)

(ii) Propene, structural formula of which is $[CH_3-CH=CH_2]$. (1)

21. (i) Nylon-6

Monomer Caprolactum

Structure

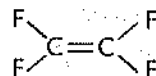


(1)

(ii) Teflon

Monomer Tetrafluoroethene

Structure



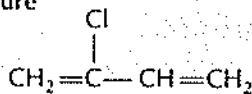
Tetrafluoroethene

(1/2)

(iii) Neoprene

Monomer Chloroprene

Structure



22. On the basis of magnitude of intermolecular forces, polymers are classified into following classes. (1/2)

1. Elastomers They have weakest intermolecular forces.
2. Fibres They have strong intermolecular forces like hydrogen bonding. (1/2)
3. Thermoplastics They are capable of remoulding. They have intermediate intermolecular forces. (1/2)
4. Thermosetting polymers They have extensive cross linking and cannot be remoulded. (1/2)

23. (i) Bakelite is used for making electrical accessories and in varnishes and lacquers. (1)

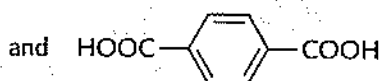
(ii) Nylon-6 is used for making tyre cords and fabrics. (1)

Polymers

24. (i) Nylon-66 is used for making parachute fabrics and ropes, socks etc. (1)

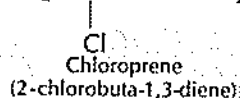
(ii) PVC is used for insulating electric wires and is used for vinyl floorings. (1)

25. (i) $\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$
Ethylene glycol



Terephthalic acid (1/2)

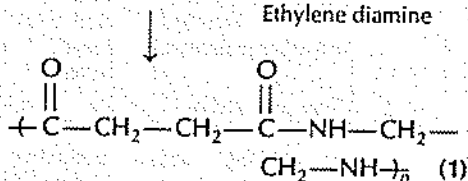
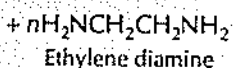
(ii) $\text{CH}_2=\text{C}(\text{Cl})-\text{CH}=\text{CH}_2$ (1/2)



(iii) $\text{CH}_2=\text{CH}-\text{Cl}$ (1/2)
Vinyl chloride

(iv) $\text{CF}_2=\text{CF}_2$ (1/2)
Tetrafluoroethene

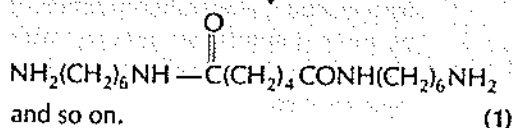
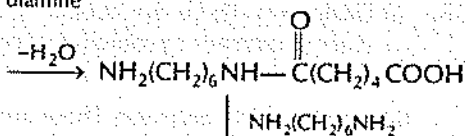
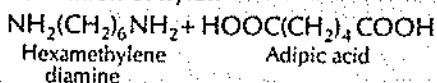
26. $n\text{HOOC}-\text{CH}_2-\text{CH}_2-\text{COOH}$
Succinic acid (1)



27. The condensation polymerisation progress through step by step and is called step growth polymerisation. Nylon and bakelite are examples of condensation polymers. (1)

In this polymerisation reaction elimination of small molecules such as H_2O , HCl etc., takes place.

Formation of nylon



28.

S.No.	Elastomers	Fibres
1.	These are rubber like solids with elastic properties.	These are the thread forming solids which possess high tensile strength.
2.	These are held together by the weakest intermolecular forces. e.g. buna-S and buna-N	These are held by strong intermolecular forces like hydrogen bonding. e.g. nylon-66 and terylene

(2)

29. Homopolymers when polymers are formed by addition of single repeating monomeric species, they are called homopolymers.

Example polythene. (1)

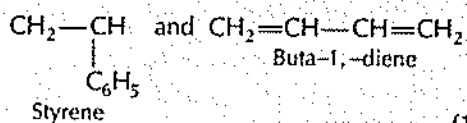
Copolymer When polymers are formed by addition of more than one repeating monomeric species, they are called copolymers.

Example buna-S. (1)

30. (i) Vulcanisation make natural rubber hard and more elastic. It has more wear and tear properties. (1)

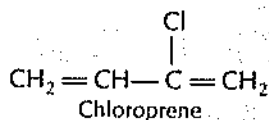
(ii) The monomeric units of nylon-66 and nylon-6 are adipic acid, hexamethylene diamine and caprolactum, respectively. Each of them contains 6 carbon atoms and it is represented by this numeric value of 6,6 and 6 in nylon-66 and nylon-6. (1)

31. (i) Monomer of buna-S is styrene and buta-1,3-diene,



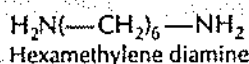
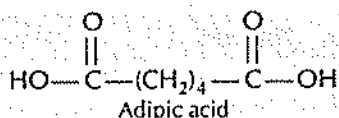
(1)

(ii) Monomer of neoprene is chloroprene.



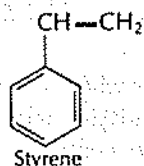
(1)

(iii) Monomer of nylon-6,6 is adipic acid and hexamethylenediamine.



32. (i) Polystyrene

Monomer Styrene (Vinyl benzene)
Structure

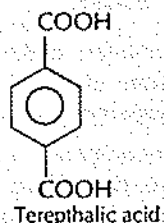


(ii) Dacron

Monomer -1. Ethylene glycol.

2. Terephthalic acid.

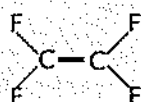
Structure $\text{HOH}_2\text{C}-\text{CH}_2\text{OH}$ and



(iii) Teflon

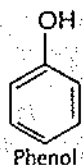
Monomer Tetrafluoroethene

Structure



33. (i) Bakelite

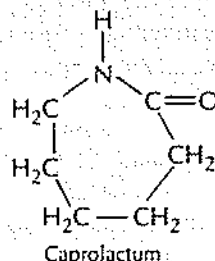
Monomers



and HCHO
Formaldehyde

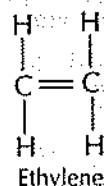
(ii) Nylon-6

Monomers



(iii) Polythene

Monomers



34.

S.No.	Thermoplastic polymer	Thermosetting polymer
1.	These are linear or slightly branched long chain molecules.	These are cross-linked or heavily branched molecule.
2.	These are capable of repeatedly softening on heating and hardening on cooling.	On heating they undergo extensive crosslinking and become infusible.
3.	Intermolecular forces are intermediate of elastomer and fibres.	Intermolecular forces are strongest.
4.	These can be reused e.g., polythene, polyvinyl chloride (PVC)	These cannot be reused e.g., bakelite, urea formaldehyde resin.

(1)

35. (i) Elastomers These are rubber like solids with elastomer properties and have strongest intramolecular forces. (1)

(ii) Condensation polymers These are formed by repeated condensation reaction of two or more bifunctional groups, with the elimination of small molecules like H_2O , HCl , etc. (1)

(3)

Polymers

(iii) **Addition polymers** When same monomeric species repeated polymerizes to form polymers, without eliminating any molecule, they are called addition polymers. (1)

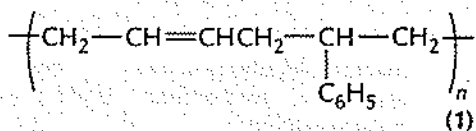
36. Addition polymers are obtained when molecules of same or different monomers combine to form a large polymer without the elimination of small molecules like PTFE. (1/2)

Condensation polymers are obtained when molecules of two or more bifunctional monomers undergo a series of condensation reaction with the elimination of small or simple molecules like HCl, H₂O, NH₃, etc. (1/2)

- (i) Polythene Addition polymer (1/2)
- (ii) PTFE Addition polymer (1/2)
- (iii) Polybutadiene Addition polymer (1/2)
- (iv) Bakelite Condensation polymer (1/2)

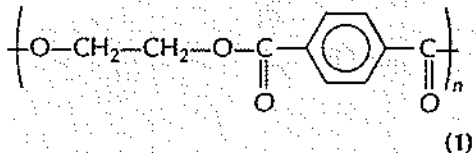
37. (i) **Buna-S**
Monomers 1,3 - butadiene and styrene. (1)

Structure

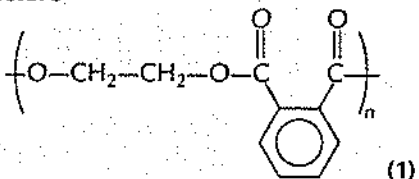


(ii) **Dacron**
Monomers Terephthalic acid and ethylene glycol. (1/2)

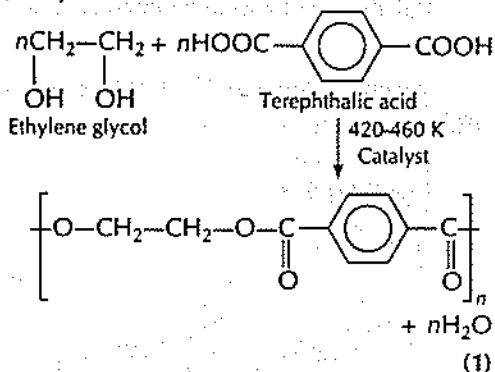
Structure



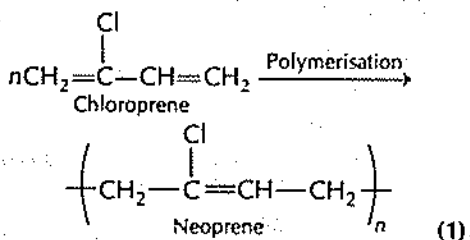
(iii) **Glyptal**
Monomers Phthalic acid and ethylene glycol.
Structure



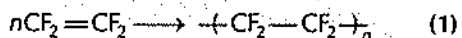
38. (i) **Terylene**



(ii) **Neoprene**



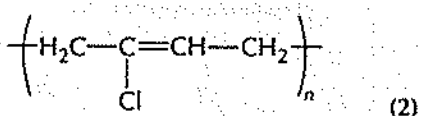
(iii) **Teflon**



39. (i) Refer ans. 8. (1)

(ii) **Neoprene (synthetic rubber)** is obtained by free radical polymerisation of chloroprene units.

The structure of the polymer is as



40. The polymers in which unsaturated monomers combine together without the loss of any molecule are called addition polymers. (1)

The two types of addition polymers are

- (i) **Homopolymers** When addition polymerisation of single monomeric species takes place e.g., polyethene. (1/2 + 1/2 = 1)
- (ii) **Copolymers** When two different monomers add, they give copolymers e.g., buna-S is a copolymer of 1,3-butadiene and styrene. (1/2 + 1/2 = 1)

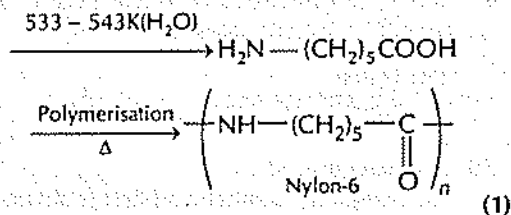
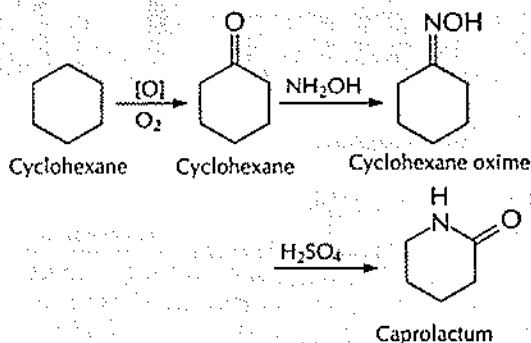
41. Refer to ans. 22. (2)

Polythene belongs to thermoplastic polymer. (1/2)

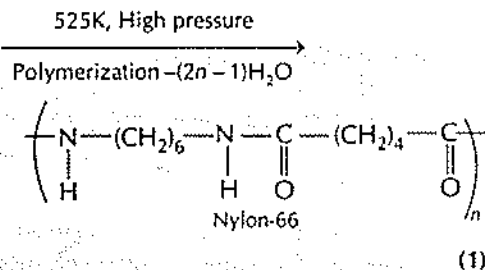
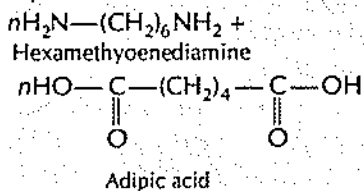
Bakelite belongs to thermosetting plastics. (1/2)

42. (i) Polythene (1)
 (ii) Bakelite (1)
 (iii) Buna-S (1)

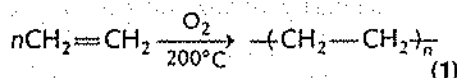
43. (i) Nylon-6



(ii) Nylon-66



(iii) Polythene



44. The polymers that can be broken into small segments by enzyme catalysed reactions are called biodegradable polymers. The required enzymes are produced by microorganisms. (1)
 Example. PHBV (Poly-β-hydroxy-butyrate-co-β-hydroxy valerate) (1)
 It is used in packaging orthopaedic devices etc. (1)

45. Monomers should possess more than one functional group. (3)

46. The process of formation of macromolecules/polymers from their respective monomeric units, is called polymerisation. (3)

47. (i) CH₂=CH₂ (Ethene) (1)

(ii) CH₂=CH (Vinyl chloride) (1)
 Cl

(iii) CF₂=CF₂ (Tetrafluoroethylene) (1)