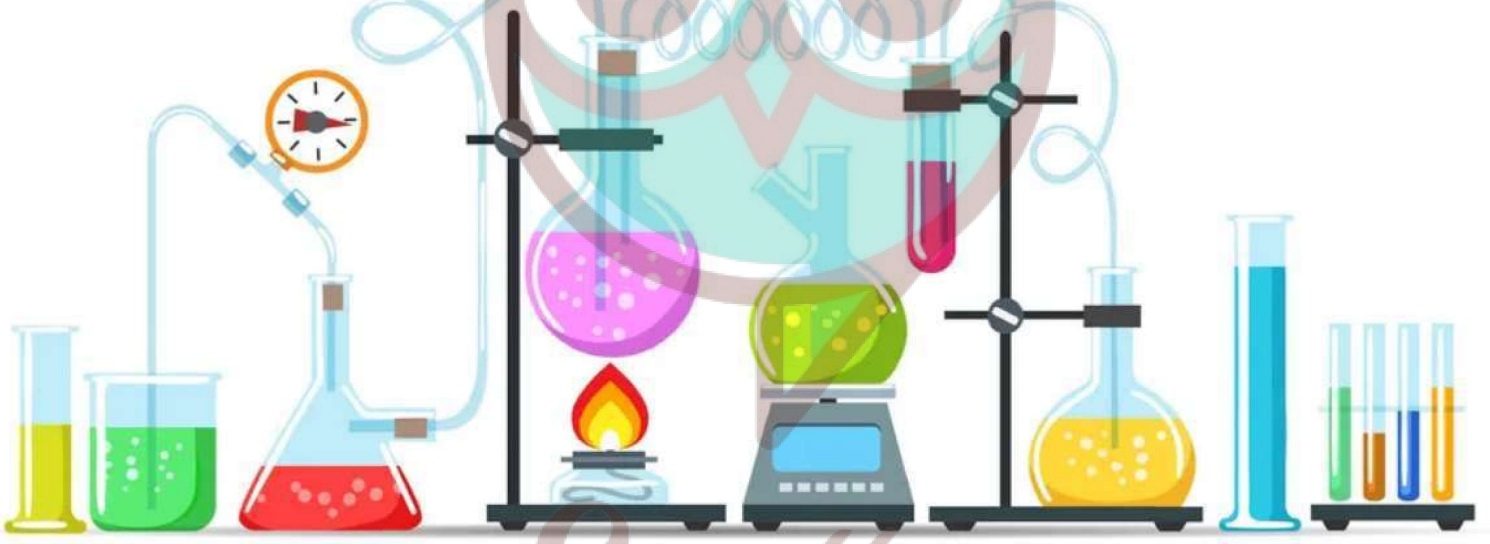
CHEMISTRY



Important Questions

Multiple Choice questions-

1. Monomer of [-$(CH_3)_2$ C CH_3-]
(a) 2-Methyl propene
(b) Styrene
(c) Propylene
(d) ethene.

2. Bakelite is
(a) addition polymer
(b) elastomer
(c) thermoplastic
(d) thermosetting.

3. Buna-Sis
(a) natural polymer
(b) synthetic polymer
(c) sulphur polymer
(d) none of these.

4. The S in Buna-S refers to
(a) sodium
(b) sulphur
(c) styrene
(d) just a trade name.

5. The repeating units of PTFE is
(a) $Cl_2CH—CH_3$
(b) $F_2C = CF_2$
(c) $F_3C—CF_3$
(d) $FClC = CF_2$.

6. The inter-particle forces between linear chains in Nylon-66 are
(a) H-bonds
(b) covalent bonds
(c) ionic bonds
(d) unpredictable.

7. Nylon-66 is a polyamide of
(a) vinyl chloride and formaldehyde
(b) adipic acid and methyl amine
(c) adipic acid and hexamethylene diamine
(d) formaldehyde and malamine.

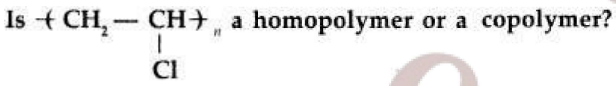
8. Which of the following is not a condensation polymer?
(a) Glyptal
(b) Nylon-66

(c) Dacron
(d) PTFE

9. Which of the following is a condensation polymer?
(a) Polystyrene
(b) Neoprene
(c) PAN
(d) Poly (ethylene glycol phthalate)

10. The monomer of PVC is
(a) ethylene x
(b) tetrafluoroethylene
(c) Chloroethene
(d) none of these.

Very Short Questions-

1. Give an example of elastomers. (Delhi, All India 2009)
2. What does the part '6, 6' mean in the name nylon-6, 6? (Delhi, All India 2009)
3. What is the primary structural feature necessary for a molecule to make it useful in a condensation polymerization reaction? (All India 2009)
4. 4. What does the designation '6, 6' mean in the name nylon-6, 6? (All India 2010)
5. 5. What is meant by 'copolymerisation'? (All India 2010)
6. What are biodegradable polymers? (Delhi 2010)
7. In nylon 6, 6, what does the designation '6, 6' mean? (Delhi 2010)
8. Define the term, 'homopolymerisation' giving an example. (Delhi 2010)
9. 

10. Give one example of a condensation polymer. (All India 2013)

Short Questions-

1. Draw the structures of the monomers of the following polymers : (Delhi 2009)
   (i) Teflon
   (ii) Polyethene
2. What is the repeating unit in the condensation polymer obtained by combining $HO_2CCH_2CH_2CO_2H$ (succinic acid) and $H_2NCH_2CH_2NH_2$ (ethylene diamine)? (Delhi 2009)
3. Differentiate between molecular structures and behaviours of thermoplastic and thermosetting polymers. Give one example of each type. (All India 2009)
4. Differentiate between condensation and addition polymerisations. Give one example each of the resulting polymers. (All India 2009)
5. Draw the molecular structures of the monomers of

(i) PVC
(ii) Teflon (All India 2010)

6. Draw the structures of the monomers of the following polymers : (All India 2010)
   (i) Bakelite
   (ii) Nylon-6
7. Mention two important uses of each of the following :
   (i) Bakelite
   (ii) Nylon 6 (Delhi 2011)
8. Name the sub-groups into which polymers are classified on the basis of magnitude of intermolecular forces. (Delhi 2011)
9. Draw the structure of the monomer for each of the following polymers : (Delhi 2012)
   i. Nylon-6
   ii. Polypropene
10. Define thermoplastic and thermosetting polymers. Give one example of each. (All India 2012)

Long Questions-

1. Explain the mechanism of polymerisation of ethene.
2. Differentiate between LDP and HDP.
3. What are Bakelite and Melamine? Give their structures.
4. Give monomers and preparation of Nylon – 6, 6 and Dacron.
5. How are polymers classified on the basis of structure?
6. Distinguish between the terms homopolymer and copolymer and give an example of each.
7. How can you differentiate between addition and condensation polymerisation?
8. Explain the term copolymerisation and give two examples.

Assertion and Reason Questions:

1. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

Assertion: In vulcanisation of rubber, sulphur cross links are introduced.

Reason: Vulcanisation is a free radical initiated chain reaction.

2. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

Assertion: Teflon has high thermal stability and chemical inertness.

Reason: Teflon is a thermoplastic.

MCQ Answers-

1. (c) Propylene
2. (d) thermosetting.
3. (b) synthetic polymer
4. (c) styrene
5. (b) $F_2C = CF_2$
6. (a) H-bonds
7. (c) adipic acid and hexamethylene diamine
8. (d) PTFE
9. (d) Poly (ethylene glycol phthalate)
10. (c) Chloroethene

Very Short Answers-

1. Buna-S, Buna-N.
2. Nylon '6,6' implies that it is a condensation polymer of two types of monomer molecules each containing six carbon atoms i.e. adipic acid ($HOOC(CH_2)_4 COOH$) and hexamethylenediamine ($H_2N CH_2 CH_2 CH_2 CH_2 CH_2 CH_2 NH_2$)
3. The presence of two bifunctional monomer molecules undergo condensation with the loss of simple molecule of water, alcohol to form dimer.
4. Since both adipic acid and hexamethylenediamine contain six carbon atoms each.
5. When two or more different monomers are allowed to polymerize together, the product formed is called a copolymer and the process is called copolymerisation.
6. Biodegradable polymers : All those biopolymers which disintegrate by themselves in biological systems during certain period of time by enzymatic hydrolysis are called biodegradable polymers.

   Example : Poly-p-Hydroxybutyrate-Co-p-Hydro- xyvalerate (PHBV)

Uses : These are used

- in packaging
- in orthopaedic devices
- in controlled drug release
- in bacterial degradation

7. Since both adipic acid and hexamethylenediamine contain six carbon atoms each.
8. The polymer formed by the polymerization of a single/same monomeric species is known as homopolymerization.

   Example : Polythene/PVC/Polypropene.

9. Answer:

   $-\{CH_2-CH(Cl)\}_n-$ is a ***homopolymer*** as it is made up of some monomer units

10. Example : Nylon 6,6

Short Answers-

1. Answer:

Teflon (Polytetrafluoroethene)

$$nCF_2=CF_2 \xrightarrow[\text{High pressure}]{\text{Catalyst}} \{CF_2-CF_2\}_n$$

Tetrafluoroethene — Teflon

Polyethene

$$nCH_2=CH_2 \longrightarrow \{CH_2-CH_2\}_n$$

Ethene — Polyethene

2. Answer:

(*i*) **PVC** (Polyvinyl chloride)

$$nCH_2=CH-Cl \longrightarrow -[CH_2-CH(Cl)]_n-$$

Vinyl chloride — Polyvinyl chloride (PVC)

Teflon (Polytetrafluoroethene)

$$nCF_2=CF_2 \xrightarrow[\text{High pressure}]{\text{Catalyst}} \{CF_2-CF_2\}_n$$

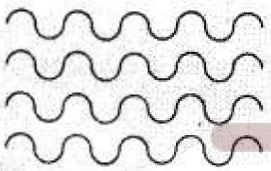
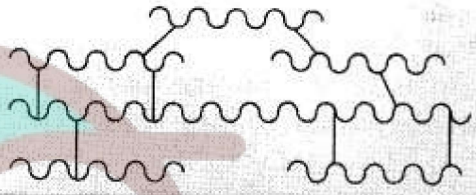
Tetrafluoroethene — Teflon

Polyethene

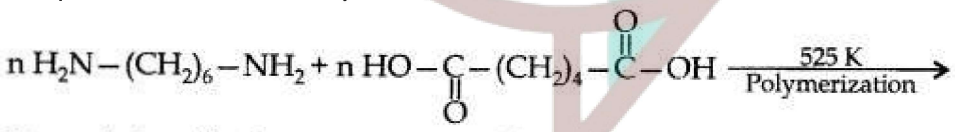
$$nCH_2=CH_2 \longrightarrow \{CH_2-CH_2\}_n$$

Ethene — Polyethene

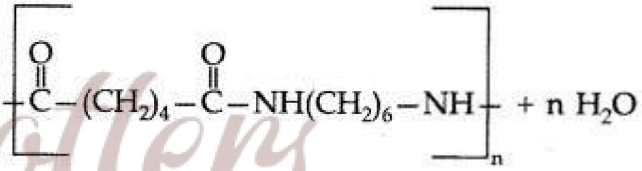
3. Answer:

Thermoplastic polymers	*Thermosetting polymers*
(*i*) These polymers have intermolecular forces of attraction between those of elastomers and fibres.	(*i*) These are semifluid substances with low molecular masses which when heated in a mould, undergo change in chemical composition to give a hard, infusible and insoluble mass.
(*ii*) These are linear or slightly branched chain polymers which are hard at room temperature and become soft and viscous on heating and again rigid on cooling. 	(*ii*) These have extensive cross-linking between different polymers chain to give a three dimensional network solid on heating. 
(*iii*) These can be melted again and again without any change.	(*iii*) These can be heated only once when these are permanently set into a solid which cannot be remelted and reworked.
Example : PVC, polyethene	***Example :*** Bakelite, melamine

4. Answer: Condensation polymerisation : In this, two or more bifunctional molecules undergo a series of independent condensation reactions with the elimination of simple molecules like H_2O, alcohol, NH_3, CO_2, HCl etc. to form a macromolecule.
Example : Formation of nylon 6, 6

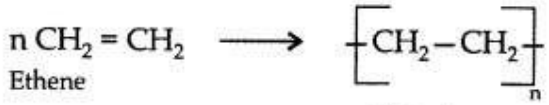


Hexamethylene diamine Adipic acid



Nylon-6, 6

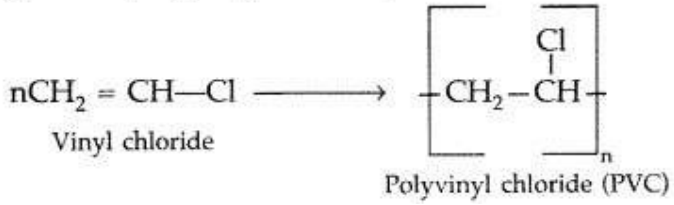
Addition polymerisation : In this, the molecules of the same or different monomers simply add on one another to form macromolecule. These molecules occur among molecules containing double and triple bonds.
Example : Formation of polyethene



Ethene Polyethene

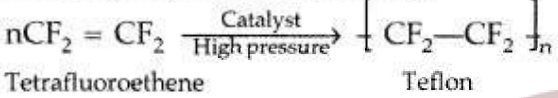
5. Answer:

(*i*) **PVC** (Polyvinyl chloride)



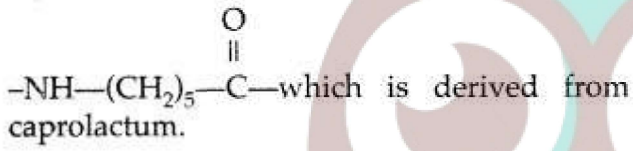
(ii)

Teflon (Polytetrafluoroethene)



6. Answer: (i) Bakelite : Phenol and formaldehyde → Condensation polymer.

(ii) Nylon-6 : The monomeric repeating unit of Nylon-6 is



which is derived from caprolactum.

7. Answer:

(i) Bakelite :

(a) It is used in making handles of utensils.

(b) Also used in production of billiard balls, dominoes and pieces for games like chess.

(ii) Nylon 6 :

(a) Nylon is used in making stockings.

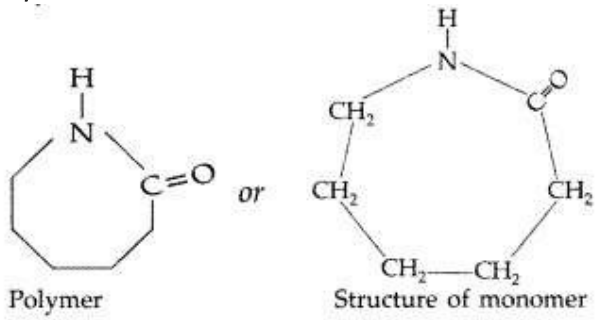
(b) It is also used for making parachutes.

8. Answer:

1. Elastomers
2. Fibres
3. Thermoplastic polymers
4. Thermosetting polymers.

9. Answer:

(i) Nylon-6 :



Polymer Structure of monomer

(*ii*) **Polypropene** : $+CH_3-CH=CH_2+$

Propene

10. Answer: Thermoplastic polymers : Linear polymers in which the intermolecular forces of attraction are in between those of elastomers and fibres and can be melted again and again on heating followed by moulding to give desired shape.
Example : Polyethene, Polyvinyl chloride (PVC) etc.

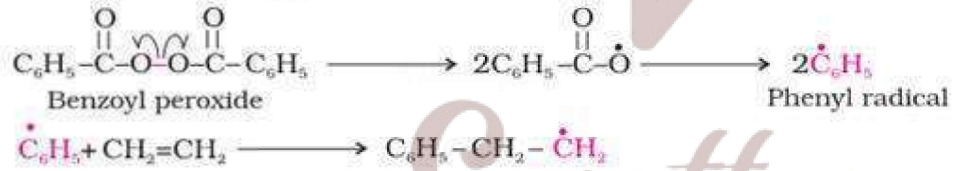
Thermosetting polymers : These are semifluid substances with low molecular masses which when heated in a mould, undergo change in chemical composition to give a hard, infusible and insoluble mass. These cannot be re-melted.
Example : Bakelite, Melamine etc.

Long Answers-

1. Ans. Polymerisation of ethene takes place by free radical mechanism. It follows a three step mechanism:-

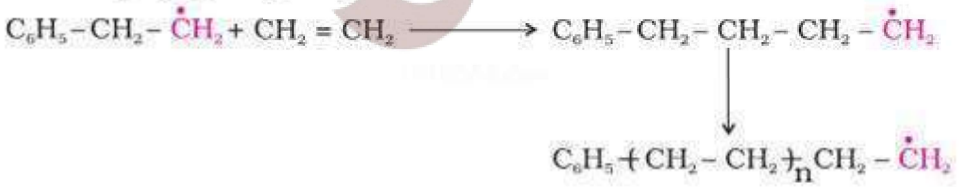
Step I: chain initiating step formation of phenyl free radical.

Chain initiation steps

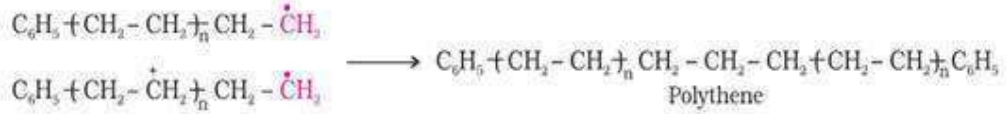


Step II:

Chain propagating step



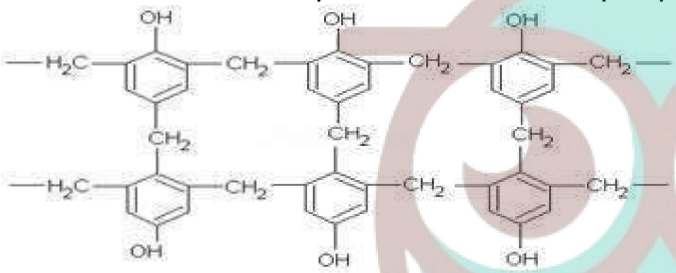
Step III: Chain termination step



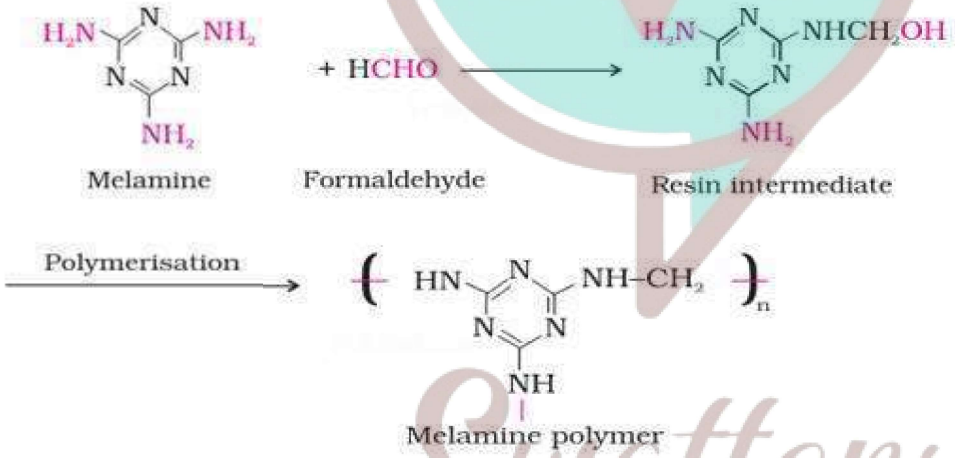
2. Ans.

(LDP) Low Density Polythene	(HDP) High Density Polythene
1. It is obtained by polymerisation of ethane under pressure of 1000 to 2000 atm. & temperature of 350K to 570K. 2. It is prepared in the presence of dioxygen or a peroxide initiator. 3. It has highly branched structure. 4. It is chemically inert, tough and flexible. 5. It is a poor conductor of electricity. 6. It is used in toys, flexible pipes etc.	1. It is formed when polymerisation takes place in a hydrocarbon solvent in presence of a catalyst e.g. Ziegter-natta catalyst at 333K-343K and 6-7atm pressure. 2. It requires Ziegler – Natta catalyst. 3. It has a linear structure. 4. It in more tougher and harder. 5. It is used for making buckets, dustbins, pipes etc.

3. Ans. Bakelite – It is phenol – formaldehyde polymer.



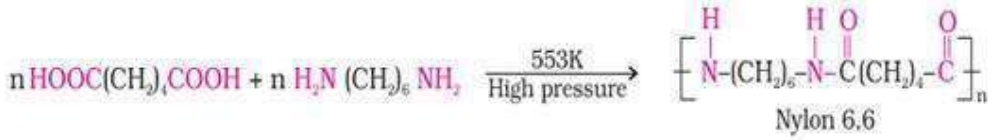
Melamine – It is melamine – formaldehyde polymer



4. Ans. Preparation

(i) Nylon – 6, 6

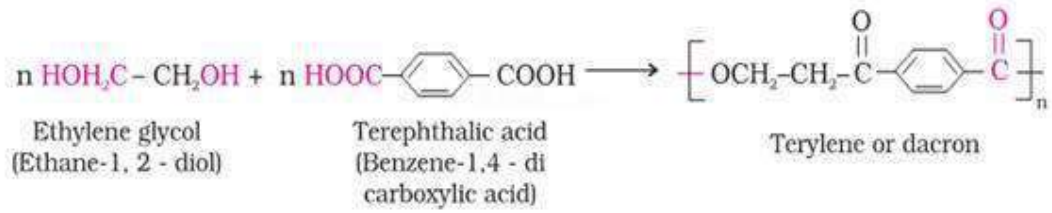
Monomers: Hexamethylene diamine Adipic acid.



(ii) Dacron

Monomers: Ethylene Glycol

Terephthalic acid



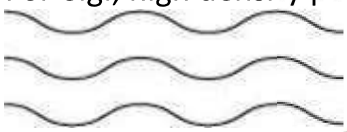
Ethylene glycol (Ethane-1, 2 - diol) | Terephthalic acid (Benzene-1,4 - di carboxylic acid) | Terylene or dacron

5. Ans. Polymers are classified on the basis of structure as follows:

1. Linear polymers:

These polymers are formed of long straight chains. They can be depicted as:

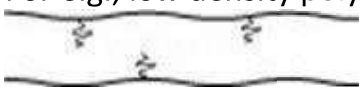
For e.g., high density polythene (HDP), polyvinyl chloride, etc.



2. Branched chain polymers:

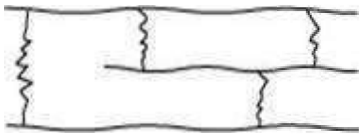
These polymers are basically linear chain polymers with some branches. These polymers are represented as:

For e.g., low density polythene (LDP), amylopectin, etc.



3. Cross-linked or Network polymers:

These polymers have many cross-linking bonds that give rise to a network-like structure. These polymers contain bi-functional and tri-functional monomers and strong covalent bonds between various linear polymer chains. Examples of such polymers include bakelite and melmac.



6. Ans.

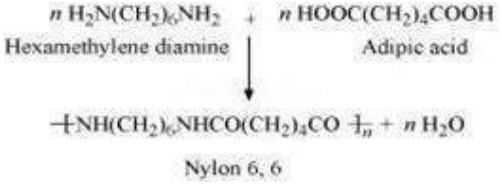
Homopolymer	Copolymer
The polymers that are formed by the polymerization of a single monomer are known as homopolymers. In other words, the repeating units of homopolymers are derived only from one monomer. For example, polythene is a homopolymer of ethene.	The polymers whose repeating units are derived from two types of monomers are known as copolymers. For example, Buna – S is a copolymer of 1, 3-butadiene and styrene.

7. Ans. Addition polymerization is the process of repeated addition of monomers, possessing double or triple bonds to form polymers. For example, polythene is formed by addition polymerization of ethene.

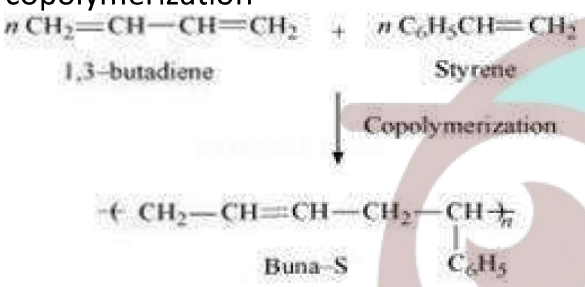
Ethene | Polyethene

Condensation polymerization is the process of formation of polymers by repeated condensation reactions between two different bi-functional or tri-functional monomers. A small molecule such as water or hydrochloric acid is eliminated in each condensation. For

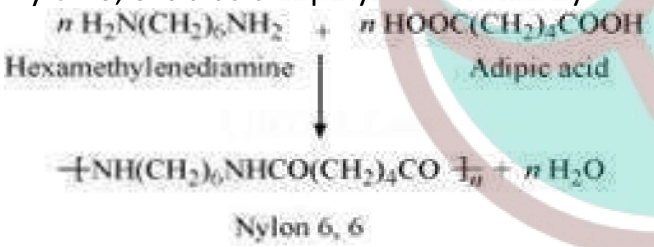
example, nylon 6, 6 is formed by condensation polymerization of hexamethylenediamine and adipic acid.



8. Ans. The process of forming polymers from two or more different monomeric units is called copolymerization. Multiple units of each monomer are present in a copolymer. The process of forming polymer Buna-S from 1, 3-butadiene and styrene is an example of copolymerization



Nylon 6, 6 is also a copolymer formed by hexamethylenediamine and adipic acid.



Assertion and Reason Answers:

1. (c) Assertion is correct statement but reason is wrong statement

Explanation:

Bakelite can be heated only once.

2. (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

Explanation:

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