26

Polymers

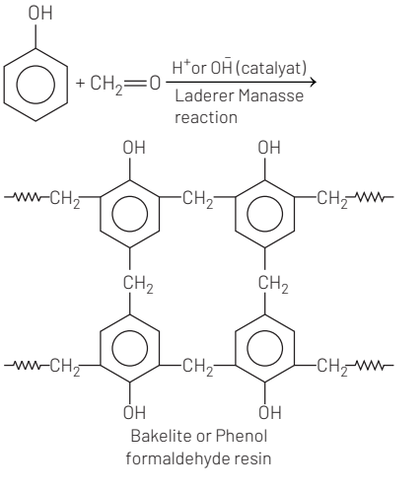
TOPIC 1
Classification of Polymers

01 Which of the following statement is correct about bakelite? **[NEET (Oct.) 2020]**

(a) It is a cross linked polymer.
(b) It is an addition polymer.
(c) It is a branched chain polymer.
(d) It is a linear polymer.

Ans. *(a)*

Bakelite is a cross linked condensation thermosetting copolymer of phenol and formaldehyde.



Bakelite or Phenol formaldehyde resin

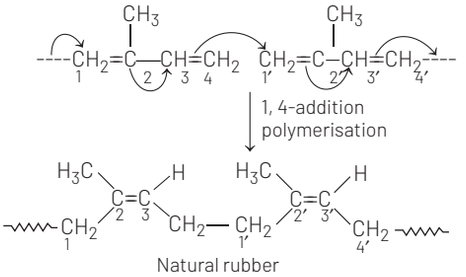
02 Which of the following is a natural polymer? **[NEET (Sep.) 2020]**

(a) Poly (Butadiene-styrene)
(b) Polybutadiene
(c) Poly (Butadiene-acrylonitrile)
(d) *Cis*-1, 4-polyisoprene

Ans. *(d)*

Natural polymer (soft) is an addition homopolymer of isoprene which is a conjugated diene.

Isoprene shows 1, 4-addition with themselves to give *cis*-1, 4-polyisoprene or natural rubber.



All polymers mentioned in options (a), (b) and (c) are synthetic 1,4-addition polymers. Where (a) and (c) are buna-S and buna-N respectively.

03 The polymer that is used as a substitute for wool in making commercial fibres is **[NEET (Odisha) 2019]**

(a) melamine (b) nylon-6, 6
(c) polyacrylonitrile (d) buna-N

Ans. *(c)*

Polyacrylonitrile or orlon or acrilan, $-(CH_2-\underset{CN}{CH})_n-$ is an addition homopolymer of monomer $CH_2=CHCN$ (vinyl cyanide). It is used in making synthetic fibres and synthetic wool. Thus, it is a substitute for wool in making commercial fibres.

04 The biodegradable polymer is **[NEET (National) 2019]**

(a) nylon-2-nylon-6 (b) nylon-6
(c) buna-S (d) nylon-6,6

Ans. *(a)*

Nylon-2-nylon-6

$-(HN-CH_2CONH(CH_2)_5\overset{O}{\overset{\|}{C}})_n-$ is a biodegradable polymer. It is an alternating polyamide copolymer of glycine (H_2N-CH_2-COOH) and amino caproic acid ($H_2N(CH_2)_5COOH$).

The remaining polymers, i.e. nylon-6,6, $-(NH(CH_2)_6NHCO(CH_2)_4CO)_n-$, nylon-6- $-(CO(CH_2)_5NH)_n-$ and buna-S

$-(CH_2-CH=CH-CH_2-\underset{C_6H_5}{CH})_n-$

are non-biodegradable polymers.

Hence, option (a) is correct.

05 Regarding cross-linked or network polymers, which of the following statements is incorrect? **[NEET 2018]**

(a) Examples are bakelite and melamine
(b) They are formed from bi- and tri-functional monomers
(c) They contain covalent bonds between various linear polymer chains
(d) They contain strong covalent bonds in their polymer chains

Ans. *(d)*

Cross-linked or network polymers are formed from bi-functional and tri-functional monomers and contain strong covalent bonds between various linear polymer chains. These are hard, rigid and brittle due to cross-links e.g. bakelite, melamine etc. Thus, option (d) is incorrect.

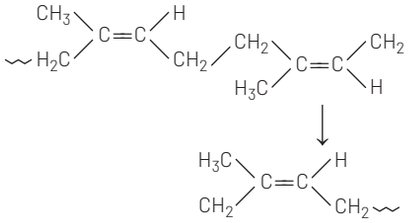
06 Natural rubber has **[NEET 2016, Phase I]**

(a) All *trans*-configuration
(b) Alternate *cis*- and *trans*-configuration
(c) Random *cis*- and *trans*-configuration
(d) All *cis*-configuration

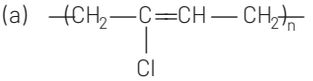
Ans. *(d)*

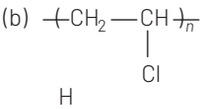
The repeating unit in natural rubber has the *cis*-configurations with chain extensions on the same side of the ethylene double bond, which is essential for elasticity. If the configuration is

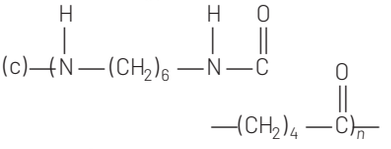
trans, the polymer is either a hard plastic or a substance like *gutta-percha.*

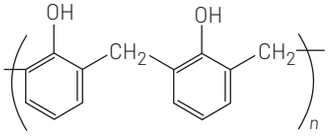


07 Which one of the following is an example of a thermosetting polymer? **[CBSE AIPMT 2014]**

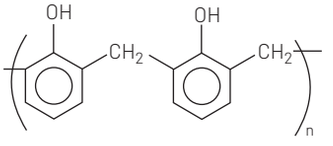
(a) 

(b) 

(c) 

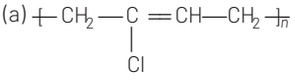
(d) 

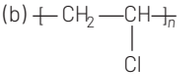
Ans. ***(d)***



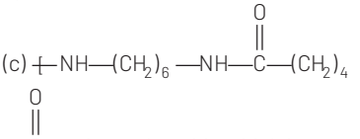
Novolac, a condensation polymer of phenol and formaldehyde is a thermosetting polymer.

Neoprene rubber

(a)  and PVC

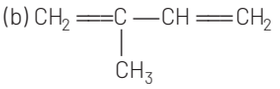
(b) 

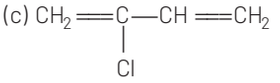
are thermoplastic polymers while nylon-66

(c)  is a polyamide which is commonly known as fibre.

08 Which is the monomer of neoprene in the following? **[NEET 2013]**

(a) $CH_2{=}CH{-}C{=}CH$

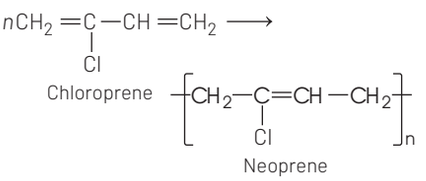
(b) 

(c) 

(d) $CH_2{=}CH{-}CH{=}CH_2$

Ans. ***(c)***

Neoprene is synthetic rubber and is a polymer of chloroprene which is chemically 2-chlorobuta- 1,3-diene.



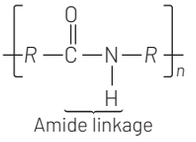
09 Nylon is an example of **[NEET 2013]**

(a) polyester (b) polysaccharide

(c) polyamide (d) polythene

Ans. ***(d)***

The general structure of any nylon polymer is



Because of the presence of amide linkage, nylon belongs to polyamides.

10 Which one of the following is not a condensation polymer? **[CBSE AIPMT 2012]**

(a) Melamine (b) Glyptal

(c) Dacron (d) Neoprene

Ans. ***(d)***

Condensation polymers are obtained by bifunctional molecules (monomers) with the elimination of smaller molecules whereas additional polymers are obtained from multiple bond containing monomers. Neoprene is a polymer of chloroprene ($CH_2{=}C(Cl){-}CH{=}CH_2$) so it is an addition polymer, not a condensation polymer.

11 Which of the following statements is false? **[CBSE AIPMT 2012]**

(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

Ans. ***(b)***

Nylon-66 is a fibre not a elastomer. As in it the forces of attraction are H-bonding . All other given statements are true.

12 Of the following which one is classified as polyester polymer? **[CBSE AIPMT 2011]**

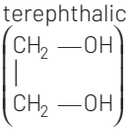
(a) Bakelite

(b) Melamine

(c) Nylon-66

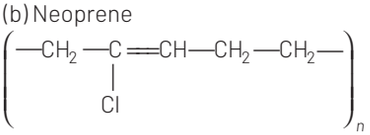
(d) Terylene

Ans. ***(d)***

Terylene (or dacron) is a polyester because it contains ester groups and formed by the monomer units terephthalic acid and ethylene glycol 

13 Structures of some common polymers are given. Which one is not correctly presented? **[CBSE AIPMT 2009]**

(a) Teflon $-(-CF_2-CF_2-)_n$

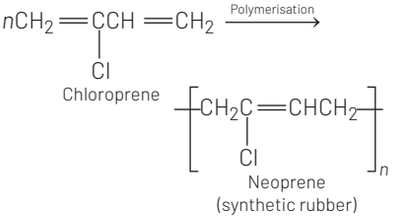
(b) Neoprene 

(c) Terylene 

(d) Nylon 66 $-[-NH(CH_2)_6NHCO(CH_2)_4-CO-]_n$

Ans. ***(b)***

Neoprene is a polymer of chloroprene (2-chloro-1,3-butadiene) and also called homopolymer addition polymer).



14 $-[-NH(CH_2)_6NHCO(CH_2)_4CO-]_n$ is a **[CBSE AIPMT 2006]**

(a) copolymer

(b) addition polymer

(c) thermo-setting polymer

(d) homopolymer

Ans. *(a)*

$-[-NH(CH_2)_6\ NHCO(CH_2)_4CO-]_n$ is a copolymer. Polymers whose repeating structural units are derived form two or more types of monomer units are called **copolymer**

$nH_2N(CH_2)_6NH_2 + nHOOC(CH_2)_4COOH \xrightarrow[-nH_2O]{\text{Polymerisation}}$

$\left[NH(CH_2)_6NHCO(CH_2)_4CO \right]_n$

15 Cellulose is a polymer of **[CBSE AIPMT 2002]**

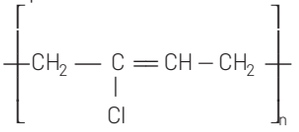
(a) glucose (b) fructose
(c) ribose (d) sucrose

Ans. *(a)*

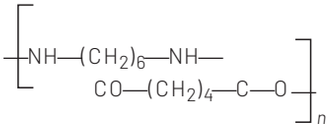
Cellulose is a polymer of glucose, i.e. $C_6H_{12}O_6$.

16 Which one of the following is not correctly matched? **[CBSE AIPMT 2001]**

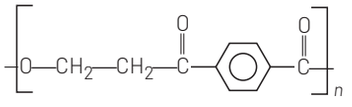
(a) Neoprene



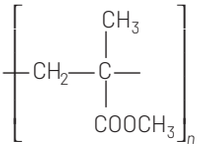
(b) Nylon-66



(c) Terylene

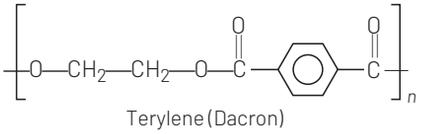


(d) PMMA



Ans. *(c)*

Terylene is formed by the condensation of dimethyl terephthalate and glycol. Its structure is



Terylene (Dacron)

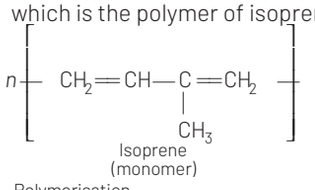
Hence, the structure of terylene given in question is incorrect.

17 Natural rubber is a polymer of **[CBSE AIPMT 1999]**

(a) butadiene (b) ethyne
(c) styrene (d) isoprene

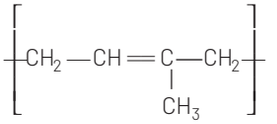
Ans. *(d)*

Polyisoprene is the natural rubber which is the polymer of isoprene.



Isoprene (monomer)

Polymerisation



Polyisoprene (natural rubber) n (polymer)

18 In elastomer, the intermolecular forces are **[CBSE AIPMT 1996]**

(a) strong (b) weak
(c) nil (d) None of these

Ans. *(b)*

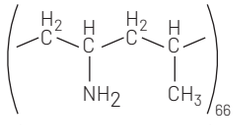
In elastomers, the polymer chains are held together by weak van der Waals' forces, e.g. natural rubber.

TOPIC 2

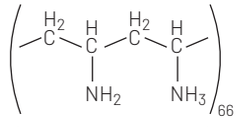
Methods of Polymerisation

19 Which one of the following structures represents nylon 6, 6 polymer? **[NEET 2016, Phase II]**

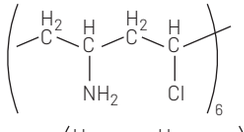
(a)

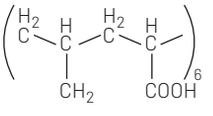


(b)

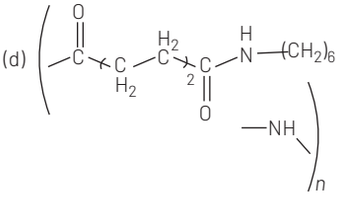


(c)



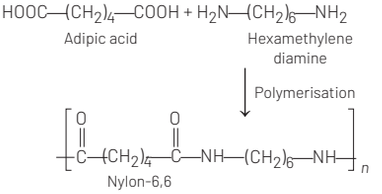


(d)



Ans. *(d)*

Nylon-6, 6 polymer is formed as



Adipic acid — Hexamethylene diamine

Polymerisation

Nylon-6,6

Thus, option (d) is correct.

20 Biodegradable polymer which can be produced from glycine and aminocapric acid is **[CBSE AIPMT 2015]**

(a) nylon 2-nylon 6
(b) PHBV
(c) buna-N
(d) nylon-6, 6

Ans. *(d)*

Nylon-2-nylon-6

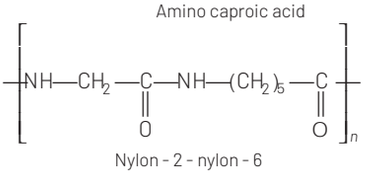
It is an alternating polyamide of glycine (containing two carbon atoms) and amino caproic acid or 6-aminohexanoic acid (containing six carbon atoms).

nH_2N-CH_2-COOH

Glycine

$+ nH_2N-(CH_2)_5-COOH \longrightarrow$

Amino caproic acid



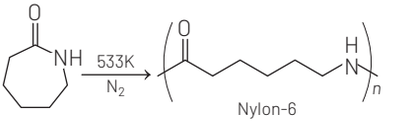
Nylon - 2 - nylon - 6

It is a biodegradable step-growth copolymer.

21 Caprolactum is used for the manufacture of **[CBSE AIPMT 2015]**

(a) nylon-6 (b) teflon
(c) terylene (d) nylon-6 6

Ans. *(a)*



Nylon-6

22 Which of the following organic compounds polymerises to form the polyester dacron?

[CBSE AIPMT 2014]

(a) Propylene and *para* —HO—(C_6H_4)—OH

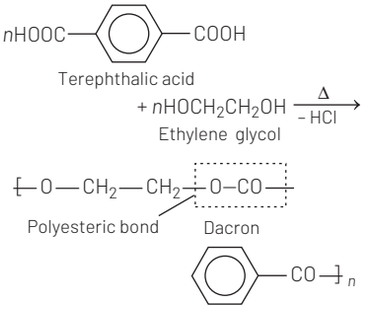
(b) Benzoic acid and ethanol

(c) Terephthalic acid and ethylene glycol

(d) Benzoic acid and *para* —HO—(C_6H_4)—OH

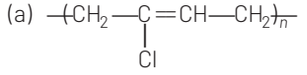
Ans. *(c)*

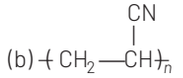
Dacron, commonly known as terylene, is obtained by heating a mixture of terephthalic acid and ethylene glycol at 420-460 K in the presence of zinc acetate and antimony trioxide as a catalyst.

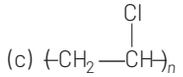


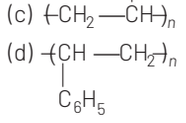
23 Which of the following structures represents neoprene polymer?

[CBSE AIPMT 2010]

(a) 

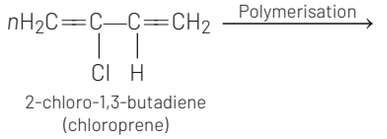
(b) 

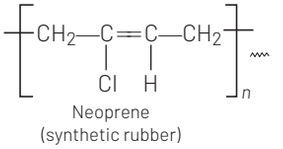
(c) 

(d) 

Ans. *(a)*

Neoprene (synthetic rubber) is a polymer of chloroprene, i.e. 2-chloro-1, 3-butadiene.





24 Which one of the following statements is not true?

[CBSE AIPMT 2008]

(a) In vulcanisation, the formation of sulphur bridges between different chains make rubber harder and stronger

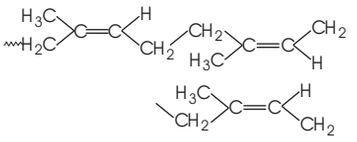
(b) Natural rubber has the *trans*-configuration at every double bond

(c) Buna-S is a copolymer of butadiene and styrene

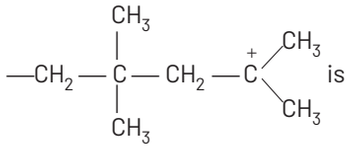
(d) Natural rubber is a 1,4-polymer of isoprene

Ans. *(b)*

Natural rubber is *cis*-1, 4-polyisoprene and has all *cis* configurations about the double bond as shown below. It is prepared from latex which is obtained *in cis* form called Havia Rubber latex is obtained from rubber tree (Havea brasiliensis).



25 The monomer of the polymer



[CBSE AIPMT 2005]

(a) $H_2C=C(CH_3)(CH_3)$

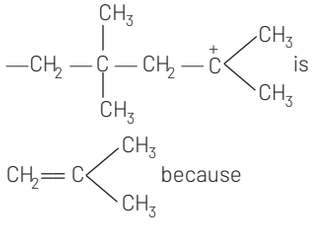
(b) $(CH_3)_2C=C(CH_3)_2$

(c) $CH_3CH=CH\cdot CH_3$

(d) $CH_3CH=CH_2$

Ans. *(a)*

The monomer of polymer



2-methylpropene shows cationic polymerisation.

26 Which one of the following is a chain growth polymer ?

[CBSE AIPMT 2004]

(a) Starch

(b) Nucleic acid

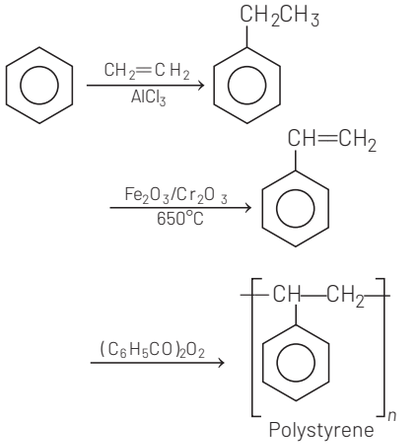
(c) Polystyrene

(d) Protein

Ans. *(c)*

Chain growth polymerisation requires an initiator (such as organic peroxides) to produce a free radical to which the monomers are added in a chain fashion. Initiators are added in a very small quantities and are decomposed by heat, light or oxidation-reduction reaction to produce reactive species, e.g. free radical.

Polystyrene is an example of chain growth polymer because in it styrene molecules are associated in the form of monomer



27 Which one of the following monomers gives the polymer neoprene on polymerisation?

[CBSE AIPMT 2003]

(a) $CH_2=\underset{Cl}{C}CH=CH_2$

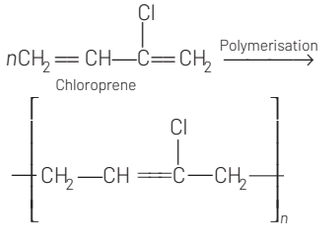
(b) $CF_2=CF_2$

(c) $CH_2=CHCl$

(d) $CCl_2=CCl_2$

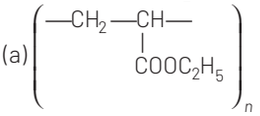
Ans. *(a)*

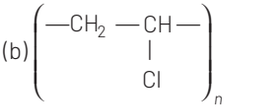
Neoprene is an addition polymer of chloroprene or chloro-1,3-butadiene (monomer).

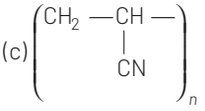


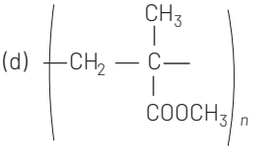
28 Acrilan is a hard, horny and a high melting material. Which of the following represents its structure?

[CBSE AIPMT 2003]

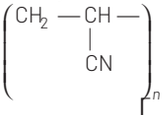
(a) 

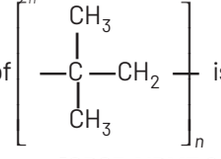
(b) 

(c) 

(d) 

Ans. *(c)*

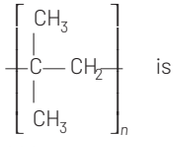
Acrilan (or acrylonitrile) is monomer unit of polyacrylonitrile (PAN). Its structure is 

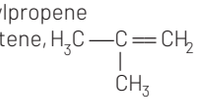
29 Monomer of  is

[CBSE AIPMT 2002]

(a) 2-methylpropene
(b) styrene
(c) propylene
(d) ethene

Ans. *(a)*

Monomer of  is

2-methylpropene or isobutene, 

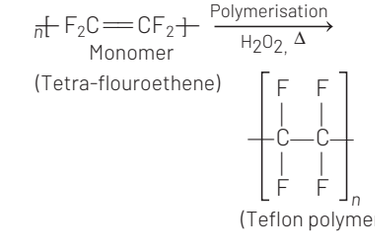
30 $CF_2 = CF_2$ is a monomer of

[CBSE AIPMT 2000]

(a) buna-S
(b) teflon
(c) glyptal
(d) nylon-6

Ans. *(b)*

$F_2C = CF_2$ is a monomer of well known plastic teflon, a material inert to almost all chemicals.



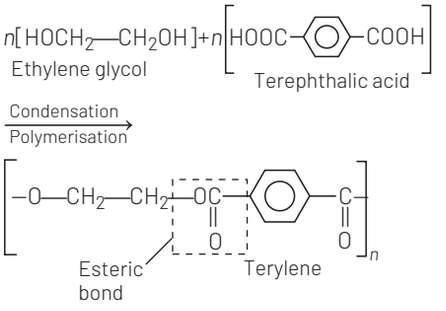
31 Terylene is a condensation polymer of ethylene glycol and

[CBSE AIPMT 1999]

(a) benzoic acid (b) phthalic acid
(c) salicylic acid (d) terephthalic acid

Ans. *(d)*

Terylene is a condensation polymer of ethylene glycol and terephthalic acid. It is also called polyester



32 Which one of the following is used to make 'non-stick' cookware ?

[CBSE AIPMT 1997]

(a) PVC
(b) Polystyrene
(c) Polyethylene terephthalate
(d) Polytetrafluoro ethylene

Ans. *(d)*

Polytetrafluoro ethylene $(C_2F_4)_n$ or teflon is used to make non-stick cookware, because it is a tough material, resistant to heat and also the bad conductor of electricity.

33 Nylon-66 is a polyamide obtained by the reaction of

[CBSE AIPMT 1996]

(a) $COOH(CH_2)_4COOH + H_2NC_6H_4NH_2$-(*p*)
(b) $COOH(CH_2)_4COOH + NH_2(CH_2)_6NH_2$
(c) $COOH(CH_2)_6COOH + NH_2(CH_2)_4NH_2$
(d) $COOHC_6H_4COOH$-(*p*)$+NH_2(CH_2)_6NH_2$

Ans. *(b)*

The monomer units of nylon-66 are obtained by the reaction of hexamethylene diamine and adipic acid.

34 Bakelite is prepared by the reaction between **[CBSE AIPMT 1995]**

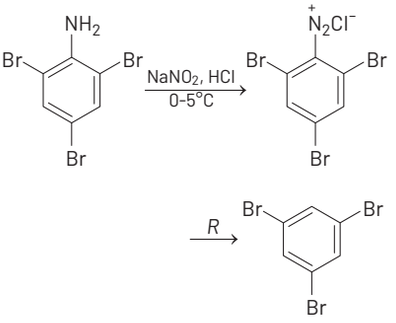
(a) urea and formaldehyde
(b) ethylene glycol
(c) phenol and formaldehyde
(d) tetramethylene glycol

Ans. *(c)*

Bakelite is a polymer obtained by the condensation reaction between phenol and formaldehyde. It is a condensation polymer and basic unit of Bakelite is Novolac.

35 The reagent '*R*' in the given sequence of chemical reaction is

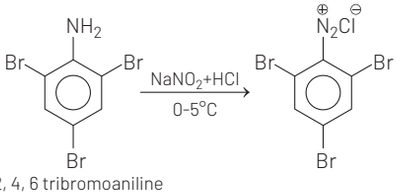
[NEET 2021]



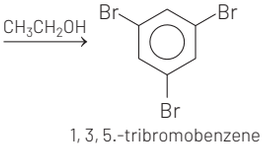
(a) H_2O (b) CH_3CH_2OH
(c) HI (d) CuCN/KCN

Ans. *(d)*

Mild reducing agents like alcohol are used to reduce diazonium salts to arene. Alcohol (ethanol is oxidised to aldehyde (ethanal).



2, 4, 6 tribromoaniline



1, 3, 5.-tribromobenzene

∴ Reagent used is CH_3CH_2OH(ethanol).