Class 12 Polymers Important Questions with Answers

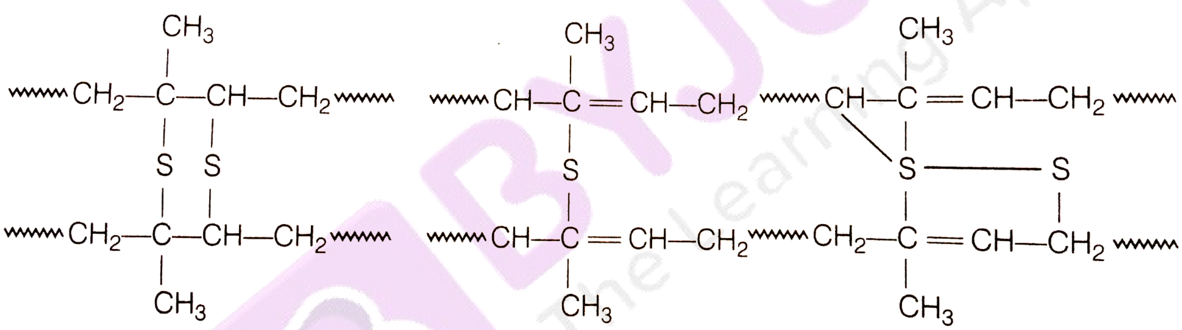
Short Answer Type

Q1. A natural linear polymer of 2-methyl-1,3-butadiene becomes hard on treatment with sulphur between 373 to 415 K and -S-S-bonds are formed between chains. Write the structure of the product of this treatment?

Answer:

The product is called vulcanised rubber.

Structure of Vulcanised Rubber.



Q2. Identify the type of polymer.

—A—A—A—A—A—A—

Answer:

In this structure, the same molecule 'A' are joined with each other to form the polymer —A—A—A—A—A—A—.So here the monomer is –A-. Since the identical monomer is being repeated to form this above polymer, this is a homopolymer. ('Homo' means identical)

Q3. Identify the type of polymer.

—A—B—B—A—A—A—B—A—

Answer:

In this structure, the different molecules are joined with each other to form the polymer —A—B—B—A—A—A—B—A—.So here, the monomer is –A– and –B–. Since different monomers are being repeated to form this polymer, this is a copolymer.

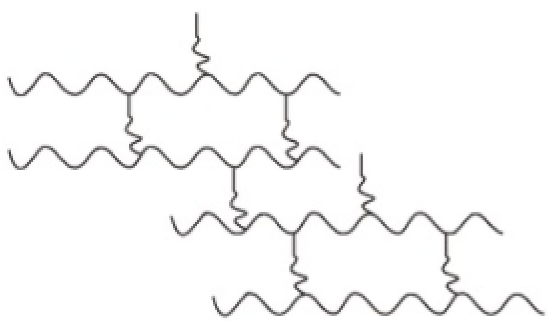
Q4. Out of chain growth polymerisation and step-growth polymerisation, which type will you place the following?

$$\left(A\right)_m + \left(A\right)_n \longrightarrow \left(A\right)_m\left(A\right)_n \text{ or } \left(A-A\right)_{m+n}$$

Answer:

This is a type of chain-growth polymerisation; as no loss of small molecules like water, methanol occurs.

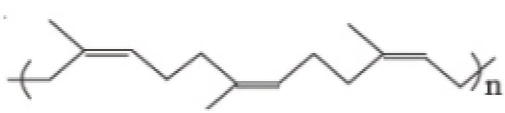
Q5. Identify the type of polymer given in the following figure.



Answer:

The polymer mentioned above is cross-linked or network polymer, since joining the polymer chains forms a three-dimensional network structure (giant molecule).

Q6. Identify the polymer given below:



Answer:

The given polymer is formed by 1, 4-addition of 2-methylbeta- 1, 3- diene (isoprene) and its stereochemistry is 'cis'. Therefore, the given polymer is 'cis' - polyisoprene, i.e., natural rubber.

Q7. Why are rubbers called elastomers?

Answer:

Rubbers are stretched on applying force and regain their original state after the force is removed. Therefore, rubbers are called elastomers.

Q8. Can an enzyme be called a polymer?

Answer:

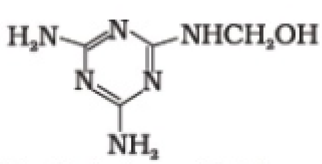
Enzymes are biocatalysts. They are proteins. Thus, they are also considered polymers.

Q9. Can nucleic acids, proteins and starch be considered step growth polymers?

Answer:

Yes, we can consider nucleic acid, protein, and starch as step-growth polymers because they remove water or any neutral molecule during their polymerisation reaction.

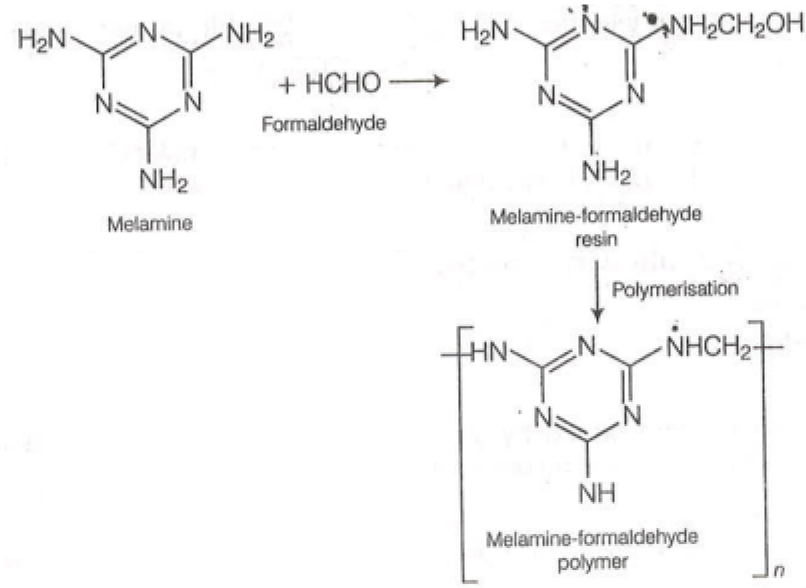
Q10. How is the following resin intermediate prepared, and which polymer is formed by this monomer unit?



(Resin intermediate)

Answer:

The given intermediate is formed by the condensation polymerisation of melamine and formaldehyde. Its polymerisation gives melamine formaldehyde.



Q11. To have practical applications, why are cross-links required in rubber?

Answer:

The cross-links make the rubber hard tough with greater tensile strength. The vulcanised rubber has excellent elasticity, low water absorption tendency, resistance to oxidation and organic solvents.

Q12. Why does cis-polyisoprene possess elastic property?

Answer:

The cis-polyisoprene molecule consists of various chains held together by weak can der Walls interactions and has a spiral structure. Thus, it can be stretched like a spring and exhibits elastic properties.

Q13. What is the structural difference between HDP and LDP? How does the structure account for different behaviour and nature, hence using a polymer?

Answer:

HDP (High-Density Polymer) consists of a linear molecule and high density due to close packing. It is a translucent polymer. While LDP (Low-Density Polymer) has a highly branched structure and hence, does not pack well, resulting in low density. It is a transparent polymer.

Q14. What is the role of benzoyl peroxide in addition to the polymerisation of alkenes? Explain its mode of action with the help of an example.

Answer:

The role of benzoyl peroxide is to generate free radicals. A variety of alkenes or dienes and their derivatives are polymerised in the presence of a free radical generating initiator (catalyst) like benzoyl peroxide, tert-butyl peroxide, etc.
For example, the polymerisation of ethene with a small amount of benzoyl peroxide initiator. The process starts with adding phenyl free radical formed by the peroxide to the ethane double bond, thus generating a new and more significant free radical. This step is called the chain initiating step.

Q15. Which factor imparts crystalline nature to a polymer like nylon?

Answer:

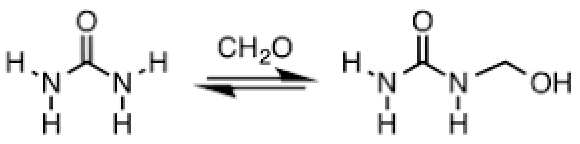
Strong intermolecular forces like hydrogen bonding lead to close chains that impart the crystalline character of nylon polymer.

Q16. Name the polymers used in laminated sheets and give the name of monomeric units involved in its formation.

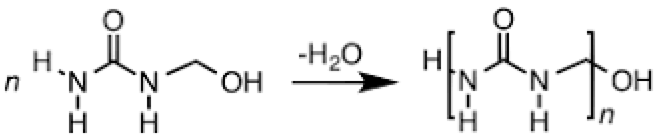
Answer:

Urea-formaldehyde resin is used in laminated sheets.

The formation of this resin is given below.



Urea formaldehyde



Thus, urea and formaldehyde are the monomeric units for the formation of laminated sheets.

Q17. Which type of biomolecules has some structural similarity with synthetic polyamides? What is this similarity?

Answer:

Proteins have structural similarities with synthetic polyamides. Polyamides and proteins both contain amide linkage.

Q18. Why should the monomers used in addition to polymerisation through the free radical pathway be very pure?

Answer:

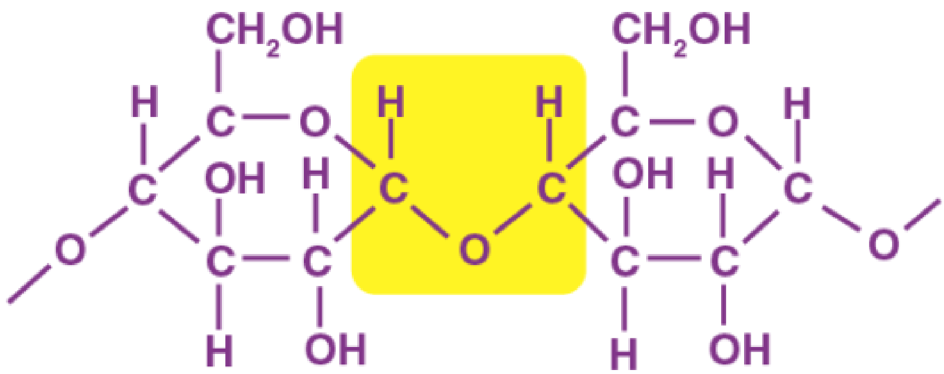
Monomers used in addition to polymerisation through the free radical pathway should be very pure; even the traces of impurities may act as inhibitors, leading to the formation of polymers with shorter chain lengths.

Long Answer Type Question

Q1. Synthetic polymers do not degrade in the environment for a long time. How can biodegradable synthetic polymers be made? Differentiate between biopolymers and biodegradable polymers and give examples of each type.

Answer:

Synthetic polymers are non-biodegradable as they are resistant to environmental degradation. They form a significant share of the polymer solid waste material.
Biopolymers are natural polymers of amino acids or carbohydrates linked by peptide or glycosidic linkages. They are found in plants and animals.



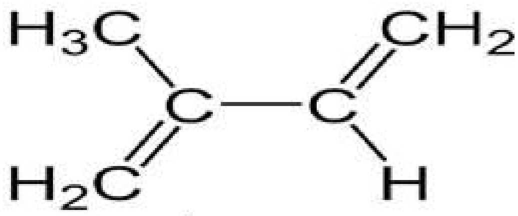
Simple starch

Biopolymer may or may not be biodegradable. For example, Protein and Starch are biodegradable, while keratin is not. The biodegradable polymer is polymers that are not resistant to the environmental degradation process, e.g., DHBV nylon-2 and nylon-6. Both the biodegradable polymers and biopolymers contain similar functional groups.

Q2. Differentiate between rubbers and plastics on the basis of intermolecular forces.

Answer:

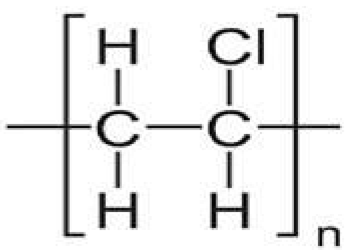
Rubber is a natural polymer capable of returning to its original length, shape, and size after the removal of forces (stretching or deformation). Rubber is a typical example of an elastomer.
Rubber is the product when the molecules of isoprene undergo polymerisation. Rubber has a spiral structure. The chains of polyisoprene are held together by weak van der Waals forces.



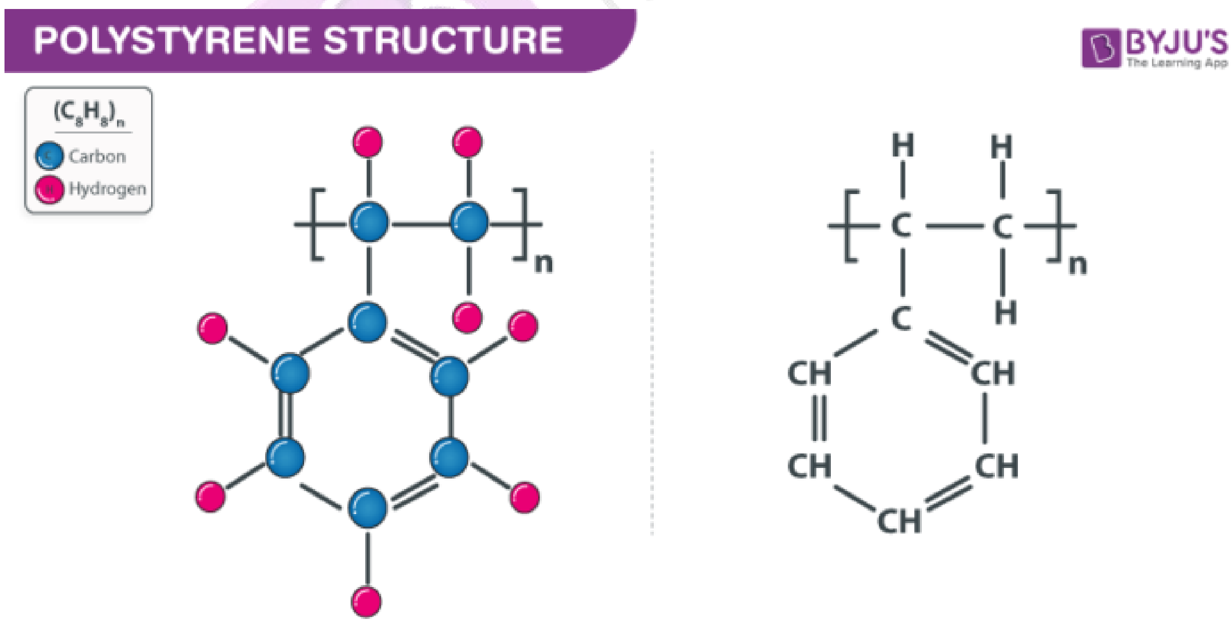
Isoprene

Plastics are synthetic or semi-synthetic polymers of organic compounds that possess intermediate intermolecular attraction forces. The forces are intermediate between those of elastomers and fibres. It has a linear structure that can be moulded but cannot regain its original shape after stretching. They are neither weak nor strong and have no cross-linkage between the chain.

A few examples of plastics are given below with the structure



Polyvinyl Chloride structure

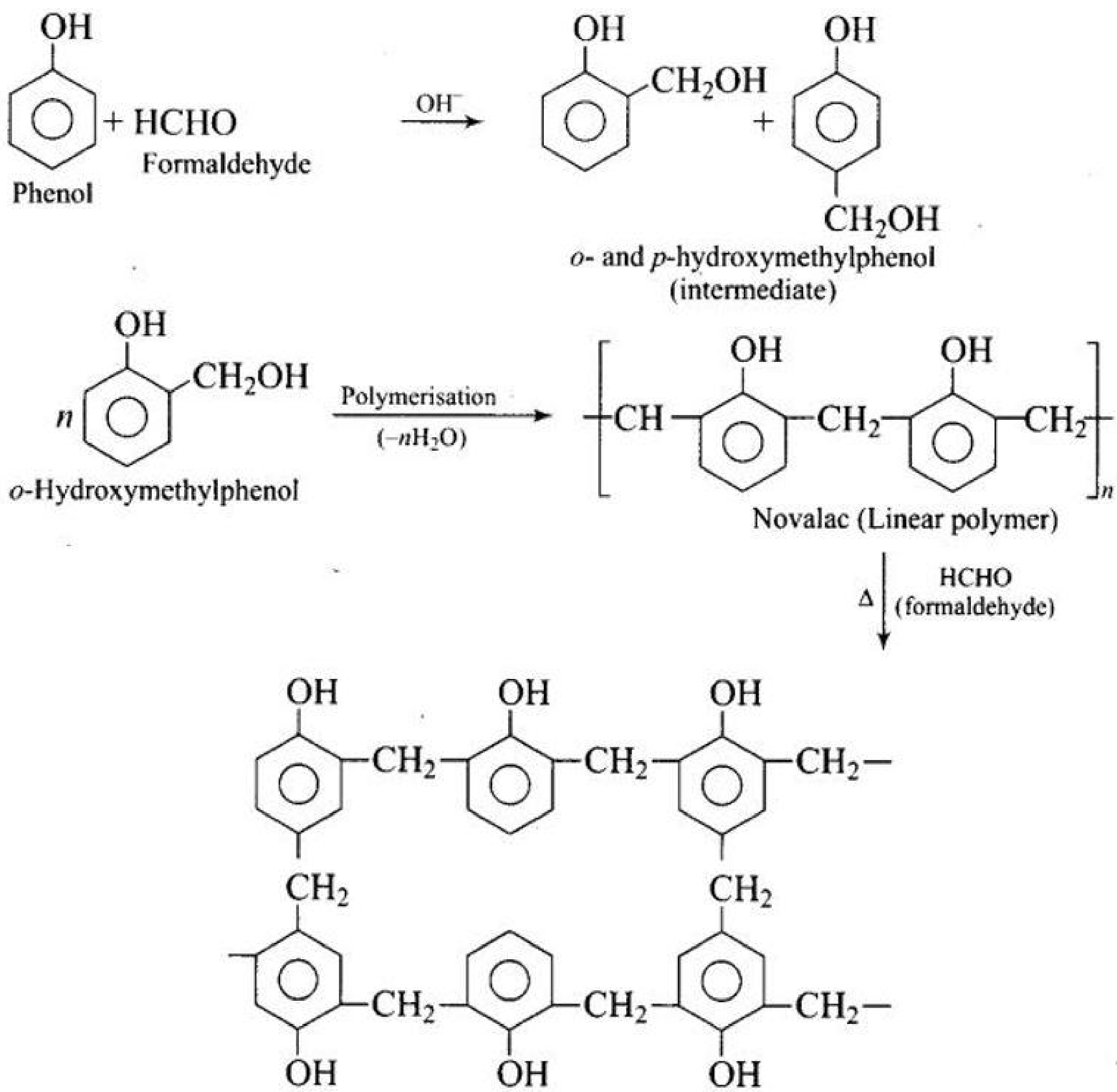


Q3. Phenol and formaldehyde undergo condensation to give a polymer (A) which on heating with formaldehyde gives a thermosetting polymer (B). Name the polymers. Write the reactions involved in the formation of (A). What is the structural difference between two polymers?

Answer:

Polymer ‘A’ in the question is Novalac, and ‘B’ is bakelite.

The reactions involved are



Bakelite (Cross linked polymer)

The primary structural difference between novalac and bakelite is that novolac is a linear chain polymer while bakelite is a cross-linked polymer.

Q4. Low-density polythene and high-density polythene are polymers of ethene, but there is a marked difference in their properties. Explain.

Answer:

Low-density and high-density polythenes are obtained under different conditions. They differ in their structural features. Low-density polythenes are highly branched structures, while high-density polythene is closely packed linear molecules. Close packing increases the density of the polymer. This difference in polymer organisation leads to distinct characteristics in each material.

Q5. Which of the following polymers soften on heating and harden on cooling? What are the polymers with this property collectively called? What are the structural similarities between such polymers? Bakelite, urea-formaldehyde resin, polythene, polyvinyl, polystyrene.

Answer:

Polythene, polyvinyls, and polystyrene soften on heating and harden on cooling. These polymers are a linear array of slightly branched long-chain molecules. Such polymers are called thermoplastic polymers.

These possess intermolecular forces whose strength lies between the intermolecular forces of elastomers and fibre. At the same time, bakelite urea and formaldehyde resin are thermosetting polymers that undergo extensive cross-linking in moulds and become infusible on heating.