# Short Answer Questions-II

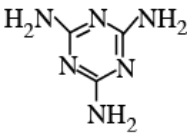
## Short Answer Questions-II (PYQ)

**Q.1. Write the structures of the monomers used for getting the following polymers:**

**[*CBSE (AI) 2017*]**

i. **Polyvinyl chloride (PVC)**
ii. **Melamine-formaldehyde polymer**
iii. **Buna-N**

**Ans.**

| S.No. | Polymer | Monomer Name | Monomer Structure |
|---|---|---|---|
| (*i*) | PVC | Vinyl chloride | $CH_2$=CH—Cl |
| (*ii*) | Melamine-formaldehyde polymer | Melamine |  HCHO |
| | | Formaldehyde | HCHO |
| (*iii*) | Buna-N | 1,3-Butadiene | $CH_2$=CH—CH=$CH_2$ |
| | | Acrylonitrile | $CH_2$=CH—CN |

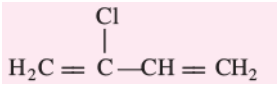
**Q.2. Write the names and structures of the monomers of the following polymers:**

i. **Nylon–6, 6**
ii. **PHBV**
iii. **Neoprene**

**[*CBSE Delhi 2015*]**

**Ans.**

| | Polymers | Monomer Structures | Monomer Names |
|---|---|---|---|

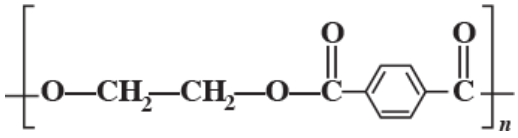
| | | | |
|---|---|---|---|
| (*i*) | Nylon-6, 6 | $H_2N(CH_2)_6NH_2$<br>$HOOC—(CH_2)_4COOH$ | Hexamethylene diamine<br>Adipic acid |
| (*ii*) | PHBV | $CH_3CH(OH)CH_2COOH$<br>$CH_3CH_2CH(OH)CH_2COOH$ | 3-hydroxybutanoic acid<br>3-hydroxypentanoic acid |
| (*iii*) | Neoprene |  | Chloroprene |

**Q.3. Answer the following question :**

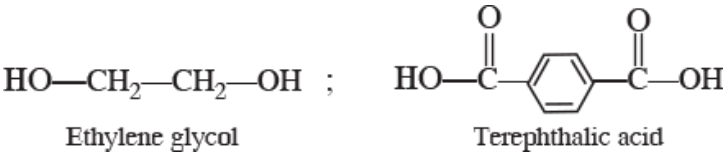
**Q. What is the role of sulphur in the vulcanisation of rubber?**

**Ans.** On vulcanisation, sulphur forms cross-links at the reactive sites of the double bond and thus rubber gets stiffened.

**Q. Identify the monomers in the following polymer:**



**Ans.**



Ethylene glycol ; Terephthalic acid

**Q. Arrange the following polymers in the increasing order of their intermolecular forces:**

**Terylene, Polythene, Neoprene**

**[*CBSE Central 2016*]**

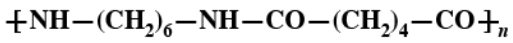
**Ans.** Neoprene < Polythene < Terylene

**Q.4. Answer the following question**

**Q. What is the role of *t*-butyl peroxide in the polymerisation of ethene?**

**Ans.** It acts as a free radical generating initiator in the chain initiation step of polymerisation of ethene.

**Q. Identify the monomers in the following polymer:**



**Ans.**


**Q. Arrange the following polymers in the increasing order of their intermolecular forces:**

**Polystyrene, Terylene, Buna-S**

**[*CBSE Delhi 2016*]**

**Ans.** Buna-S < Polystyrene < Terylene

**Q.5. Explain the following terms giving a suitable example for each:**

**Q. Elastomers**

**Ans. Elastomers:** These are the polymers having the weakest intermolecular forces of attraction between the polymer chains. The weak forces permit the polymer to be stretched. A few 'cross links' are introduced between the chains, which help the polymer to retract to its original position after the force is released as in vulcanised rubber. Elastomers thus possess an elastic character, *e.g*., buna-S, buna-N, neoprene, etc.

**Q. Condensation polymers**

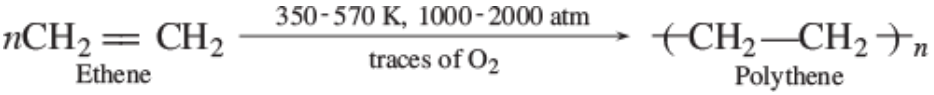
**Ans. Condensation polymers:** The condensation polymers are formed by the repeated condensation reaction between different bifunctional or trifunctional monomer

units usually with elimination of small molecules such as water, alcohol, hydrogen chloride, etc. Nylon 6, 6, nylon 6, terylene are some examples.

**Q. Addition polymers**

**[*CBSE (AI) 2012*]**

**Ans. Addition polymers:** Addition polymers are formed by repeated addition of same or different monomer molecules. The monomers used are unsaturated compounds, *e.g*., alkenes, alkadienes and their derivatives. Polythene is an example of addition polymer.




**Q.6. Give one example each of**

**Q. Addition polymers**

**Ans.** Polythene, PVC

**Q. Condensation polymers**

**Ans.** Nylon-6, Nylon-6,6

**Q. Copolymers.**

**[*CBSE Delhi 2010*]**

**Ans.** Buna-S, Buna-N.

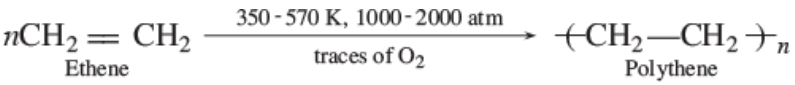
**Q.7. What are addition polymers? How are the two types of addition polymers different from each other? Give one example of each type.**

**[*CBSE (F) 2011*]**

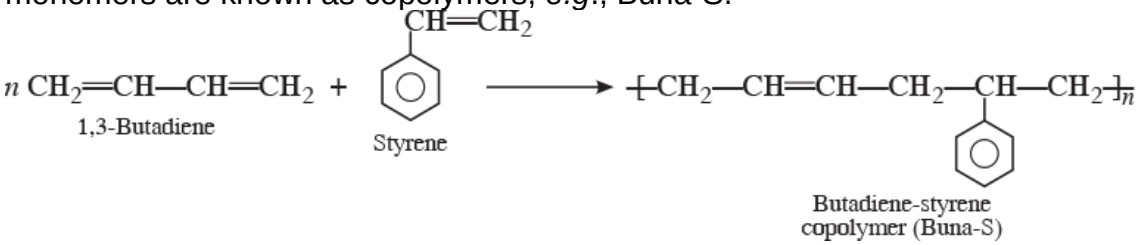
**Ans.** Polymers which are formed by the repeated addition of monomers molecules possessing double or triple bonds are called the addition polymers.

**The two types of addition polymers are:**

**i. Homopolymers:** The addition polymers formed by the polymerisation of a single monomeric species are called homopolymers, *e.g*., polythene.



**ii. Copolymers:** The polymers made by addition polymerisation from two different monomers are known as copolymers, *e.g*., Buna-S.




**Q.8. Mention two important uses for each of the following polymers:**

**[*CBSE (F) 2011*]**

**Q. Bakelite**

**Ans.** It is used for making combs, fountain pen barrels, phonograph records.

It is used widely in making electrical goods such as switches, plugs, handles of various utensils.

**Q. Nylon 6,6**

**Ans.** It is used for making combs, fountain pen barrels, phonograph records.

It is used widely in making electrical goods such as switches, plugs, handles of various utensils.

It is used in making bristles for brushes, ropes.

It is used for making carpets and fabrics in textile industry.

**Q. PVC**

**Ans.** It is used in the manufacture of raincoats, handbags, water pipes, vinyl flooring.

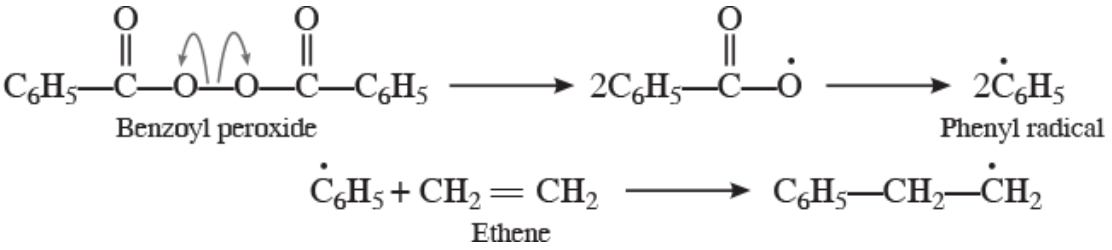
It is used for insulating electric wires.

**Q.9. Write the mechanism of free radical polymerisation of ethene.**

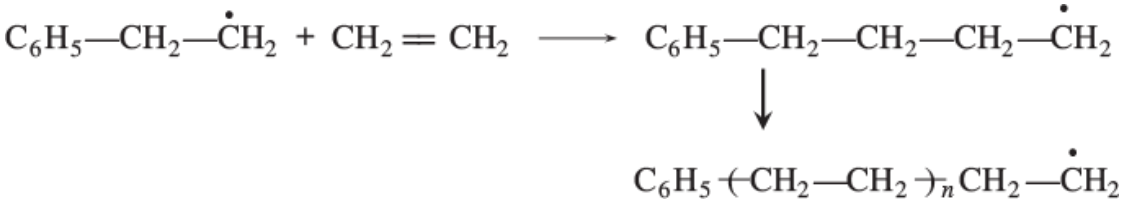
**[*CBSE Delhi 2016*]**

**Ans.** The sequence of steps governing the free radical polymerisation of ethene to form polythene are follows:

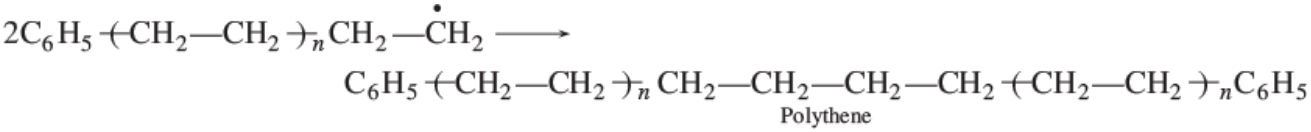
**Chain initiation step:** Benzoyl peroxide undergoes homolytic fission to form free radicals.




**Chain propagating step:**



**Chain termination step:** The chain reaction stops when two free radical chains combine.



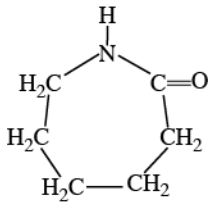

## Short Answer Questions-II (OIQ)

**Q.1. Write the structure and name of the monomers of the following polymers:**

**i. Buna-S**
**ii. Nylon-6**
**iii. Teflon.**

**Ans.**

| S.No. | Polymers | Monomer Names | Monomer Structures |
|---|---|---|---|
| ***(i)*** | Buna-S | 1, 3–Butadiene<br>Styrene | $CH_2=CH-CH=CH_2$<br>$CH_2=CH-C_6H_5$ |

| | | | |
|---|---|---|---|
| (*ii*) | Nylon-6 | Caprolactam |  |
| (*iii*) | Teflon | Tetrafluoroethene | $CF_2=CF_2$ |

**Q.2. Give one example for each of the following:**

**Q. Thermoplastic**

**Ans.** Polythene

**Q. Natural polymer**

**Ans.** Natural rubber.

**Q. Chain growth polymer**

**Ans.** PVC (polyvinyl chloride)

**Q.3. 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, polyvinyls, polystyrene.**

**[*NCERT Exemplar*] [*HOTS*]**

**Ans.** Polythene, polyvinyls and polystyrene soften on heating and harden on cooling. Such polymers are called thermoplastic polymers. These polymers are linear or slightly branched long chain molecules. These possess intermolecular forces whose strength lies between strength of intermolecular forces of elastomers and fibres.

**Q.4. Write names of monomer/s of the following polymers and classify them as addition or condensation polymers.**

i. **Teflon**
ii. **Bakelite**
iii. **Natural Rubber**

**Ans.**

| | **Polymers** | **Type** | **Monomer** |
|---|---|---|---|
| **(*i*)** | Teflon | Addition | Tetrafluoroethene |
| **(*ii*)** | Bakelite | Condensation | Phenol and formaldehyde |
| **(*iii*)** | Natural rubber | Addition | *cis*-isoprene |

**Q.5. What is vulcanisation? Why is it done? Why is diphenyl amine added to rubber?**

**Ans.** Vulcanisation is a process of heating natural rubber with sulphur. This is done so as to make it more elastic, hard, more abrasion resistant by sulphur cross-linking. Diphenyl amine is added to rubber so as to prevent its oxidation.

**Q.6. Explain the following processes with a suitable example in each case:**

**Q. Chain growth polymerization**

**Ans. Chain growth polymerisation:** This type of polymerisation involves the initial formation of a free radical or an ion (from small amount of initiator such as organic peroxide) to which monomers get added up by a chain reaction. Here, the polymers are exact multiples of organic monomeric molecules and have only carbon atoms in their main chain. Various steps involved in chain growth polymerisation of ethene are:

**a.**

$$\text{Initiator} \xrightarrow[\text{split up}]{\text{Heat, light, etc.}} \underset{\text{Free radical}}{\overset{\bullet}{\text{A}}}$$

**b.**

$$\overset{\bullet}{\text{A}} + \underset{\text{Monomer}}{\text{CH}_2 = \text{CH}_2} \longrightarrow \underset{\text{(Intermediate species)}}{\text{A—CH}_2\text{—}\overset{\bullet}{\text{C}}\text{H}_2}$$

**c.**

$$\text{A—CH}_2\text{—}\overset{\bullet}{\text{C}}\text{H}_2 + \underset{\text{Monomer}}{\text{CH}_2 = \text{CH}_2} \longrightarrow \underset{\text{(Bigger intermediate species)}}{\text{A—CH}_2\text{—CH}_2\text{—CH}_2\text{—}\overset{\bullet}{\text{C}}\text{H}_2}$$

**Examples:** polyethylene, teflon, etc.

**Q. Step growth polymerisation.**

**Ans. Step growth polymerisation:** This type of polymerisation involves a series of condensation reactions between simple monomers containing polar groups, with or without the elimination of small molecules like water, HCl, $NH_3$, etc. In addition to carbon atoms, these polymers contain other atoms also in their main chain. Steps may be illustrated as follows:

a. $\underset{\text{Monomer}}{A} + \underset{\text{Monomer}}{B} \xrightarrow{\text{Condensation}} AB$

b. $A—B + A \xrightarrow{\text{Condensation}} A—B—A$

c. $A—B + A—B \xrightarrow{\text{Condensation}} A—B—A—B.....$

Examples:Terylene, nylon, etc.

The step wise growth can also occur in another manner:

a. $A + B \xrightarrow{\text{Condensation}} A—B$

b. $AB + AB \xrightarrow{\text{Condensation}} \underset{\text{Polymer}}{ABAB.....(AB)_n}$

**Q.7. Answer the following:**

**Q. To have practical applications, why are cross links required in rubber?**

**[*NCERT Exemplar*]**

**Ans.** Cross links bind the planar polymer sheets thus increasing its elastomeric properties.

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

**[*NCERT Exemplar*]**

**Ans.** Strong intermolecular forces like hydrogen bonding, lead to close packing of chains that imparts crystalline character.

**Q. Which type of biomolecules have some structural similarity with synthetic polyamides? What is this similarity?**

**[*NCERT Exemplar*]**

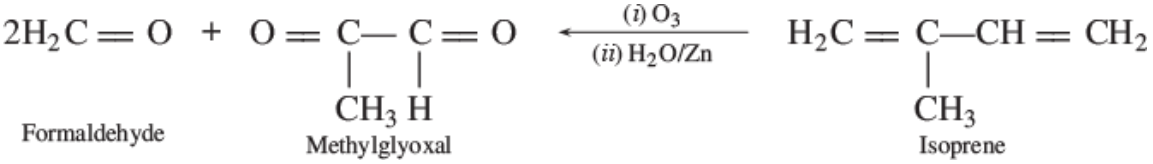
**Ans.** Proteins have structural similarity with synthetic polyamides. Polyamides and proteins both contain amide linkage.

**Q.8. A monomer of a polymer upon ozonolysis gives one mole of methylglyoxal and two moles of formaldehyde.**

i. **Identify the monomer of the polymer.**
ii. **Give its free radical mode of addition polymerisation.**

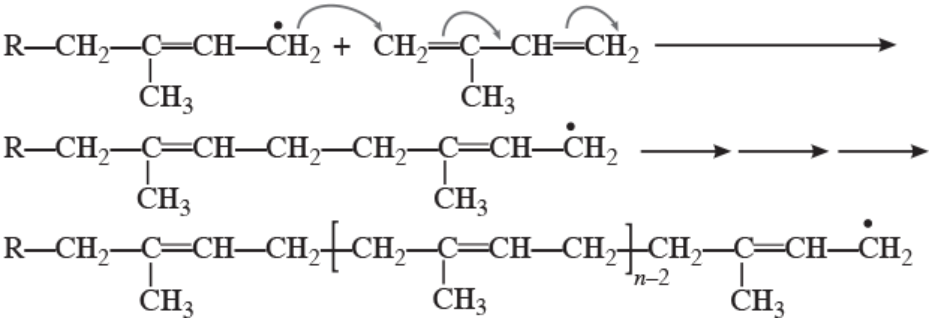
**[*HOTS*]**

**Ans. i.** As the monomer on ozonolysis gives one mole of methylglyoxal and two moles of formaldehyde, therefore, the monomer is isoprene.

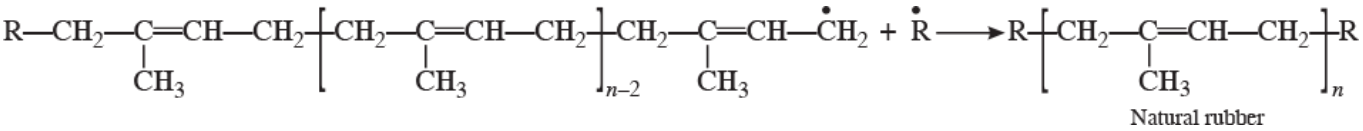



**ii.** The free radical mechanism of polymerisation of isoprene may be given as follows:


**Chain propagation:**



**Chain termination:** One of the mode of chain termination is

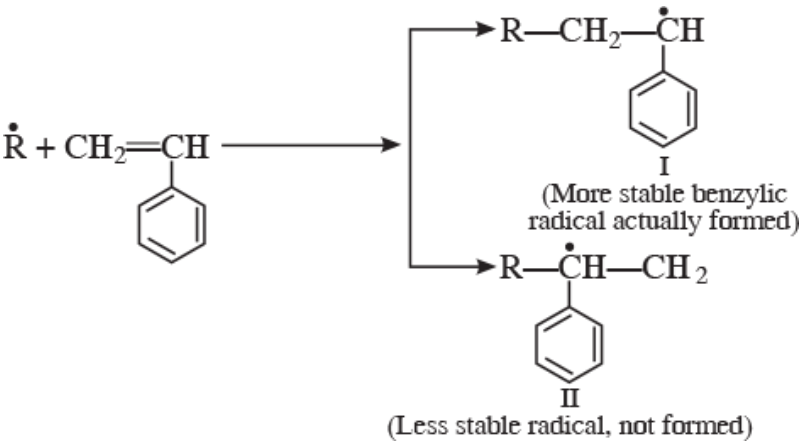



**Q.9. Explain why free radical polymerisation of styrene gives a product in which phenyl groups are on alternate carbon atoms rather than on adjacent carbon atoms.**

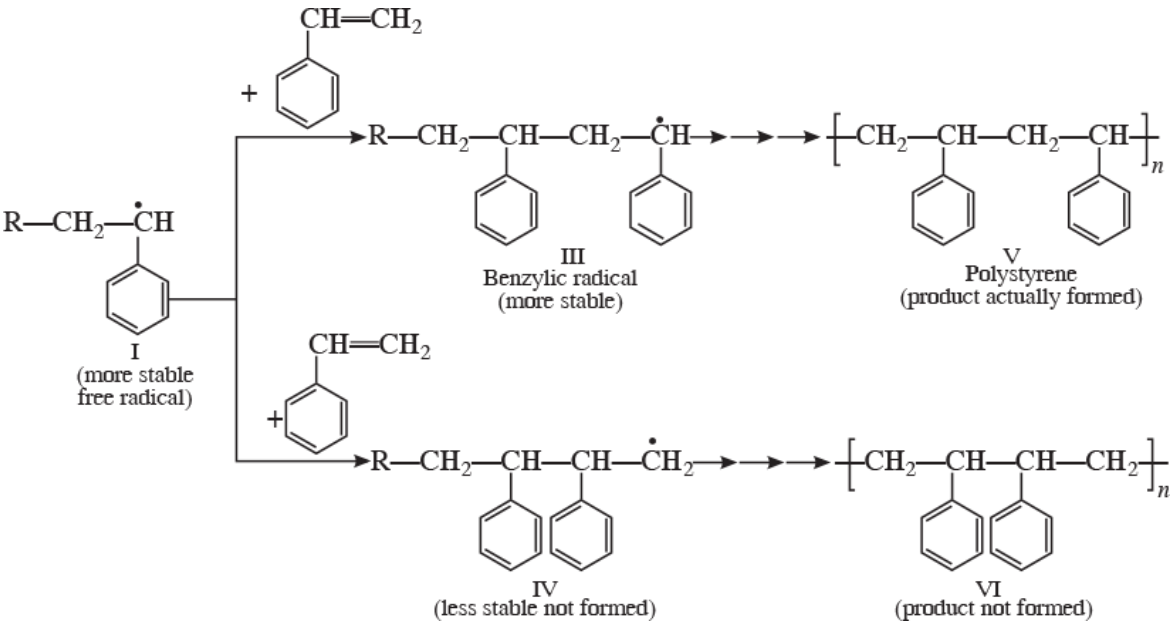
**[*HOTS*]**

**Ans.** During free radical polymerisation, the addition of free radical to monomer molecules occurs in accordance with Markovnikov's rule so as to give more stable benzylic free radical.

For example,




This process goes on till polystrene (V) in which the phenyl groups are on alternate carbon atoms is obtained rather than the product (VI) in which the phenyl groups are on adjacent carbon atoms.

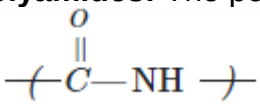



**Q.10. Briefly describe the following terms giving one example of each:**

**Q. Polyolefins**

**Ans. Polyolefins:** These are polymers derived from unsaturated hydrocarbons, for example, polypropene.

**Q. Polyamides**

**Ans. Polyamides:** The polymers having large number of amide linkage  in the chain are called polyamides, for example, nylon-6, 6 and nylon-6.

**Q. Polyesters**

**Ans. Polyesters:** These are the polycondensation products of dicarboxylic acids and diols. Dacron or terylene is the best known example of polyesters.