

# Answers

## Classification of Polymer

1	c	2	d	3	a	4	c	5	b
6	d	7	d	8	a	9	a	10	d
11	d	12	c	13	d	14	a	15	d
16	b	17	d	18	d	19	b	20	b
21	a	22	d	23	d	24	a	25	a
26	c	27	c	28	d	29	c	30	a
31	d	32	d	33	c	34	d	35	b
36	c	37	c	38	e	39	a		

## General methods of preparation and mechanism of polymerisation

1	b	2	c	3	c	4	c	5	b
6	a	7	b	8	b	9	d	10	c
11	b	12	b	13	a	14	c	15	c
16	a	17	c	18	a	19	b	20	b
21	b	22	c	23	a	24	c	25	a
26	b	27	d	28	b	29	d	30	d
31	c	32	c	33	a	34	c	35	d
36	a	37	c	38	d	39	a		

## Composition, Properties and Uses of Polymer

1	a	2	c	3	c	4	c	5	b
6	b	7	c	8	b	9	a	10	c
11	b	12	c	13	b	14	c	15	c
16	a	17	d	18	b	19	c	20	b
21	d	22	d	23	d	24	d	25	a
26	b	27	c	28	b	29	b	30	c
31	b	32	a	33	c	34	a	35	b
36	d	37	b	38	b	39	d	40	a
41	d	42	d	43	a	44	d	45	c
46	c	47	a	48	c	49	d	50	c
51	a	52	d	53	b	54	a	55	a
56	d	57	b	58	a	59	b	60	c
61	d	62	a	63	b	64	a	65	a
66	a	67	b	68	b	69	b	70	c
71	c	72	b	73	d	74	b	75	b
76	b								

## Critical Thinking Questions

1	a	2	c	3	c	4	a	5	b
6	b	7	d	8	a	9	c	10	d
11	c	12	d	13	a	14	b	15	d
16	b								

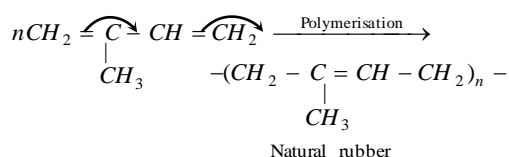
## Assertion and Reason

1	e	2	b	3	b	4	c	5	b
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# AS Answers and Solutions

## Classification of Polymer

- (c) Bakelite is thermosetting polymer. It becomes infusible on heating and can not be remoulded
- (c) Natural rubber is the only addition polymer of nature and is known as *Cis*-1,4-polyisoprene.
- (d) Wax is a molecular solid.
- (a) It is present in the cell wall of plant.
- (c) Starch is a natural polymer and other are synthetic.
- (d) Protein is a natural polymer of  $\alpha$ -amino acids.
- (d) Amylose is a linear polymer of  $\alpha$ -D-Glucose  
 $(-\text{Glucose}-\text{Glucose}-\text{Glucose}-)_n$   
 $(C_1-C_4 \alpha\text{-linkage})$
- (d) Silk is protein fibre. Dacron is polyester fibre and Nylon-66 is polyamide fibre.
- (b) Natural rubber is addition polymer of isoprene (2-methyl-1,3-butadiene)

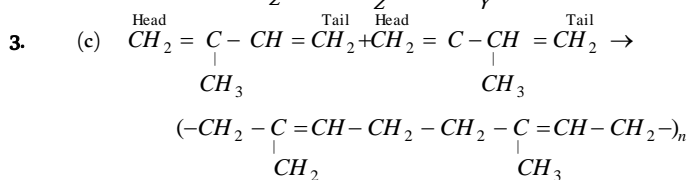
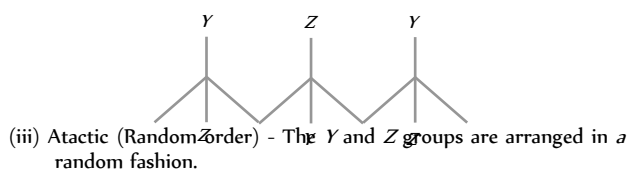
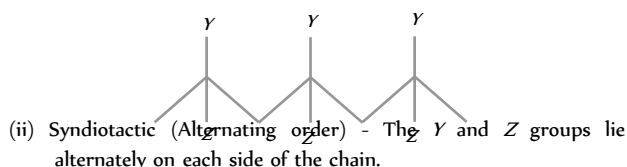


- (b) Polyethylene is a homopolymer  
 $n \text{CH}_2 = \text{CH}_2 \rightarrow \text{---} (\text{CH}_2 - \text{CH}_2)_n \text{---}$
- (a) Cellulose is the natural fibre which are biodegradable polymer rest are synthetic polymer which are not biodegradable.
- (d) Nylon is the copolymer of Hexamethylene diamine and adipic acid. It is not a homo-polymer because homopolymer formed by two same monomer unit.
- (a) Thermoplastic are those which becomes soft on heating and can be remoulded again.
- (c) Resins are amorphous organic solids or semisolids which usually have a typical lustre and are often transparent or translucent.
- (c) Step growth polymerization involves condensation reaction between two difunctional monomer to produce dimer which in turn, produce, tetramer and so on with the loss of simple molecules like  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{HCl}$  etc.
- (c) Buna-S and Neoprene both are synthetic rubber.
- (d) Nylon is a synthetic polymer.

35. (b) Nylon-66 is manufactured by the condensation polymerization of adipic acid and hexamethylenediamine with the loss of  $H_2O$  as steam.
36. (c) The polymer formed by the condensation polymerisation is known as condensation polymer. Decron (Terylene) is a condensation polymer. It is formed by the condensation polymerisation of terephthalic acid and ethylene glycol.
37. (c) PVC is a synthetic polymer made by vinylchloride.
38. (e) Terylene is fibre not a thermosetting plastic because on heating they melt and do not show plastic property while rest option are true regarding to Terylene
39. (a) Sucrose is a disaccharides which upon acid or enzymatic hydrolysis gives only two molecules of monosaccharides.
- Sucrose  $\xrightarrow{H^+ \text{ or invertase}}$  D(+)-glucose + D(-)-fructose

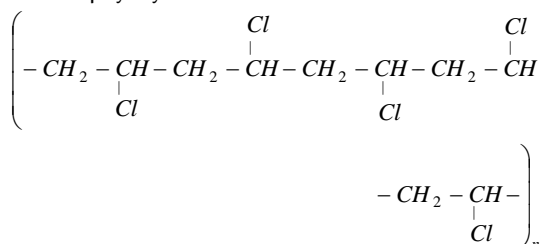
### General methods of preparation and mechanism of Polymerisation

1. (b) There are 3 stereo chemical arrangements are possible
- (i) Isotactic (Same order):- Here groups are arranged on one side of the chain. All Y groups lie on one side and all Z groups on the opposite side of the chain.

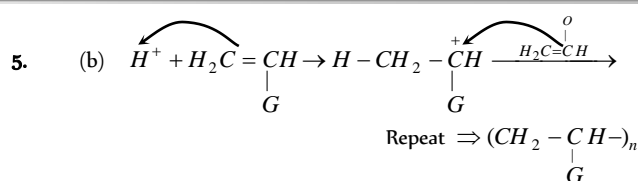


From steric effects, the polymer formed has head to tail configuration.

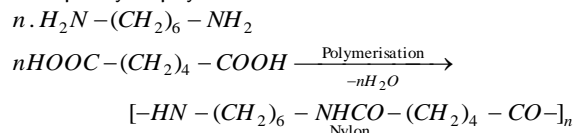
4. (c) Syndiotactic polyvinylchloride



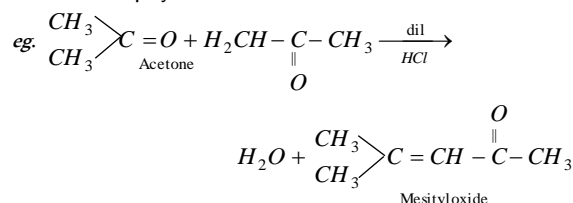
In this arrangement the chlorine atoms are alternately arranged. The polymer is stereoregular and has high crystallinity.



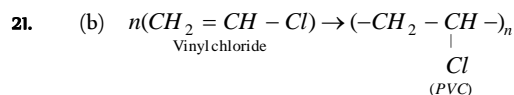
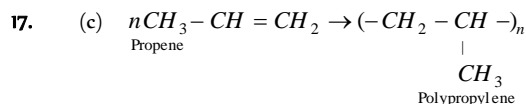
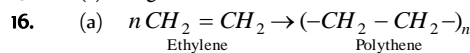
7. (b) The condensation polymerisation of hexamethylene diamine and adipic acid is done in solution form by interface technique. In this liquid nylon polymer is obtained.



8. (b) Condensation Polymerization because loss of water molecule takes place.
10. (c) eg- PVC is extremely stiff and hard but the addition of *d*-*n* butyl phthalate Plasticizers makes it soft and rubber like.
14. (c) Polymers formed by condensation process with elimination of small molecule like  $H_2O, CO_2$  etc. are known as condensation polymers.



15. (c) D-glucose is the monomer of cellulose.



22. (c) Adipic acid ( $HOOC - (CH_2)_4 - COOH$ ) and Hexamethylene diamine ( $NH_2 - (CH_2)_6 - NH_2$ )

27. (d) Tetrafluoroethene ( $CF_2 = CF_2$ ).

29. (d) Rayon fibre is chemically identical to cotton but has a shine like silk, rayon is also called a regenerated fibre because during its preparation. Cellulose is regenerated by dissolving it in  $NaOH$  and  $CS_2$ .

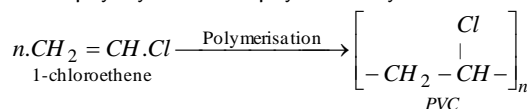
30. (d) When phenol react with  $HCHO$  form bakelite which is a thermosetting polymer.

31. (c) Generally chloroethene (vinyl chloride) formed PVC polyvinyl chloride.

33. (a)  $Al(C_2H_5)_3 + TiCl_4$  is Ziegler Natta catalyst.

37. (c) Terylene is a polymer of ethylene glycol and terephthalic acid.

38. (d) PVC is polyvinyl chloride, a polymer of vinyl chloride.



### Composition, properties and uses of Polymers

1. (a) Nylon was simultaneously discovered in New York and London.

2. (c) Teflon is flexible, inert to solvents and to boiling with acids even to aqua - regia and is stable upto 598 K.

4. (c) Both highly inflammable and Non-inflammable

5. (b) Perspex is a synthesized polymer.

6. (b) Average number molecular weight  $\overline{M}_n = 30,000$

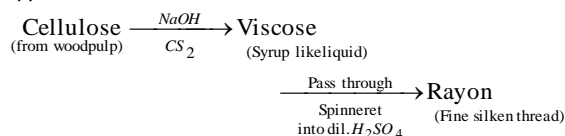
Average mass molecular weight  $\overline{M}_w = 40,000$

$$\text{Polydispersity index (PDI)} = \frac{\overline{M}_w}{\overline{M}_n} = \frac{40,000}{30,000} = 1.33$$

7. (c) Cellulose forms a translucent mass on treatment with conc.

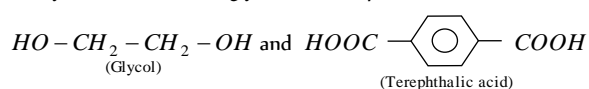
$\text{NaOH}$  which imparts a silky lustre to cotton. This process is mercerisation and the cotton so produced is known as mercerised cotton.

8. (b) 'Rayon' is man-made fibre which consists of purified cellulose in the form of long threads. Rayon resembles silk in appearance. Hence called as artificial silk.



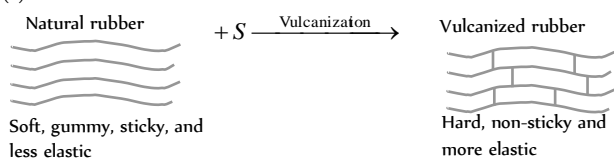
10. (c) Ziegler-Natta catalyst  $(\text{C}_2\text{H}_5)_3\text{Al} + \text{TiCl}_4$

14. (c) Terylene is made from glycol and Terephthalic acid



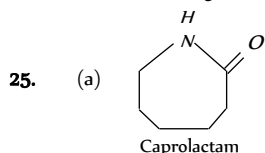
15. (c)  $n(\text{CH}_2 = \underset{\text{Cl}}{\text{C}} - \text{CH} = \text{CH}_2) \rightarrow \left[ \text{CH}_2 - \underset{\text{Cl}}{\text{C}} = \text{CH} - \text{CH}_2 \right]_n$   
Chloroprene Neoprene

19. (c)



22. (d) Polymer always consists of hundreds to thousands of repeating structural units. Hence they have very high molecular mass.

24. (d) Acrylonitrile is a hard, horny and high melting material. It is used in the manufacture of oron and Acrilan fibres which are used for making clothes, carpets and blankets.



27. (c)  $n(\text{CH}_2 = \underset{\text{Cl}}{\text{C}} - \text{CH} = \text{CH}_2) \rightarrow (-\text{CH}_2 - \underset{\text{Cl}}{\text{C}} = \text{CH} - \text{CH}_2 -)_n$   
Chloroprene Neoprene

34. (a) Ice is a molecular solid.

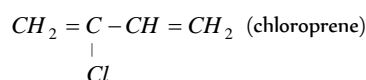
36. (d) They have linear molecules interlinked with forces like hydrogen bonding.

37. (b) Isoprene  $(\text{CH}_2 = \underset{\text{CH}_3}{\text{C}} - \text{CH} = \text{CH}_2)$

38. (b)  $n \text{CH}_2 = \underset{\text{CH}_3}{\text{C}} - \text{CH} = \text{CH}_2 \rightarrow \left[ -\text{CH}_2 - \underset{\text{CH}_3}{\text{C}} = \text{CH} - \text{CH}_2 - \right]_n$   
Natural rubber

39. (d) Polymers have high molecular weight.

40. (a) In Neoprene monomer unit is



while Isoprene  $(\text{CH}_2 = \underset{\text{CH}_3}{\text{C}} - \text{CH} = \text{CH}_2)$  is the monomer of natural rubber.

42. (d) Teflon has great chemical inertness and high thermal stability, hence used for making non-stick utensils. For this purpose, a thin layer of teflon is coated on the inner side of the vessel.

43. (a) Also known as PMMA. It is a transparent, excellent light transmitter and its optical clarity better than glass so it is used in the preparation of lenses for eyes.

45. (c) Teflon is non-inflammable and resistant to heat so it is used in coating, particularly in non-sticking frying pans.

46. (c) DDT is an organic compound used as insecticide not is a polymer.

47. (a) All the nylons are polyamides.

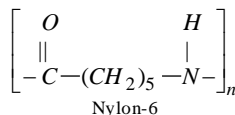
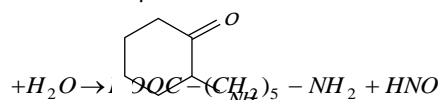
48. (c) Rubber is a polymer of isoprene. Its chemical formula is  $(\text{C}_5\text{H}_8)_n$ .

54. (a)  $n\text{CF}_2 = \text{CF}_2 \longrightarrow [-\text{CF}_2 - \text{CF}_2 -]_n$   
Tetrafluoro ethane Teflon

55. (a)  $\text{SF}_6$  is used in the vulcanisation of rubber. Sulphur is heated with polymer to introduce cross-linking and thus, form tough polymer.

58. (a)  $\text{H}_2\text{C} = \text{C} \begin{array}{l} \text{CH}_3 \\ \text{CH}_3 \end{array}$

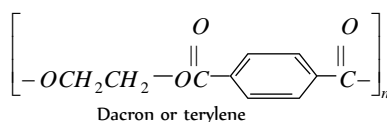
59. (b) The monomer used in the preparation of Nylon-6 is caprolactam.



64. (a) 30-Inulin  $(\text{C}_5\text{H}_{10}\text{O}_5)_{30}$  is found in the "Roots of Dahaliya".

69. (b) Polymer chain in elastomer are held together by weak intermolecular forces eg. Vulcanised rubber.

71. (c) Terylene has ester linkage. It is the polymer of ethylene glycol with terephthalic acid. It is used in textile industry.



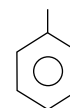
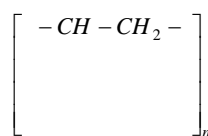
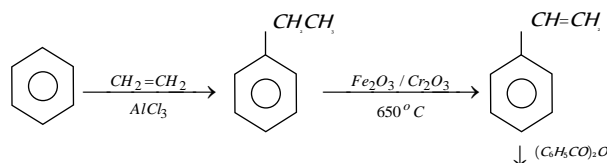
74. (b) Nylons are polyamide fibres.

76. (b) Thermosetting plastics have three dimensional cross-linked structure. Such polymers are prepared in two steps. The first step is the formation of long chain molecules which are capable of further reaction with each other. The second step is the application of heat which cause a reaction to occur between the chains, thus producing a complex cross-linked polymer.

### Critical Thinking Questions

- (a) Gutta-percha rubber is very hard horny material consisting of trans 1, 4 - polyisoprene polymer
- (c) The fibre of terylene is highly crease - resistant, durable and has low moisture content. It is also not damaged by pests like moths and mildew. It is therefore used for the manufacture of wash and wear fabrics. It is also blended with cotton (Terycot) and wool (Terywool) to increase their resistance to wear and tear.
- (c) The reaction carried out at temp.  $50^{\circ}\text{--}80^{\circ}\text{C}$ .
- (a) HDPE is prepared by co-ordination polymerization which occurs through the intermediate formation of co-ordination complexes. For example, ethylene first forms a co-ordination complex with the transition metal titanium by donating its  $\pi$  - electrons. The  $\pi$  complex thus formed then reacts stepwise with a large number of ethylene molecules ultimately leading to the formation of a polymer. The polythene so obtained has high density ( $0.97\text{ g/cm}^3$ ) and higher *m.pt.* ( $403\text{K}$ ) as compare to LDPE (density-  $0.92\text{ g/cm}^3$  and *m.pt.*  $384\text{K}$ )
- (b) Perlon is Nylon-6. It is prepared from a single monomer having a potential amino group of one end and a potential carbonyl group of other end.
- (b) Styrene at room temperature is liquid.
- (d) 
$$n \underset{\text{Propene}}{\text{CH}_3 - \text{CH} = \text{CH}_2} \rightarrow \left( \underset{\text{Polypropene}}{\text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - } \right)_n$$
- (a) Ziegler Natta catalyst is a mixture of  $\text{TiCl}_4$  and  $(\text{C}_2\text{H}_5)_3\text{Al}$  used in the synthesis of stereoregular polymers.
- (c) Melamine is the phenol-urea resin which are white crystalline solid.
- (d) Glyptal is a polymer of phthalic acid and Glycol.
- (c) Glyptal is an alkyd resin of ethylene glycol ( $\text{HO} - \text{CH}_2 - \text{CH}_2 - \text{OH}$ ).

- (d) The raw rubber is plastic in nature. It becomes soft at high temperature. It has little durability and it has large water absorption capacity.
- (a) Chain growth polymers involve a series of reaction each of which consume a reactive particles & produces another similar one. The reactive particles may be free radicals or ions (cation or anion) to which monomers get added by a chain reaction. It is an important reaction of alkenes & conjugated dienes or indeed of all kinds of compounds that contains  $\text{C}=\text{C}$  double bond



- (b) Cellulose acetate known as celanese silk.
- (d) Ebonite is a hard and highly (20-30%) vulcanized rubber.
- (b) PMMA is used in bullet proof glass.

### Assertion & Reason

- (e) The time of vulcanisation is reduced by adding accelerators and activators.
- (b) Hydrogenation or hardening of oil is a process in which various unsaturated radicals of fatty glycerides are converted into more highly or completely saturated glycerides by the addition of hydrogen in the presence of a catalyst, usually finely divided nickel.
- (b) Vulcanisation is a process of treating natural rubber with sulphur or some compounds of sulphur under heat so as to modify its properties. This cross-linking give mechanical strength to the rubber.
- (c) Bakelite can be heated only once.
- (b) Due to the presence of strong  $\text{C}-\text{F}$  bonds, teflon has high thermal stability and chemical inertness.