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Biomolecules and Chemistry in Everyday Life

Topic 1 Biomolecules

Objective Questions I (Only one correct option)

1. Which of the given statements is incorrect about glycogen?
(2019 Main, 12 April II)

(a) It is straight chain polymer similar to amylose
(b) Only α-linkages are present in the molecule
(c) It is present in animal cells
(d) It is present in some yeast and fungi

2. Which of the following statement is not true about RNA?
(2019 Main, 12 April I)

(a) It controls the synthesis of protein
(b) It has always double stranded α-helix structure
(c) It usually does not replicate
(d) It is present in the nucleus of the cell

3. Number of stereo-centers present in linear and cyclic structures of glucose are respectively **(2019 Main, 10 April II)**

(a) 4 and 5 (b) 4 and 4
(c) 5 and 4 (d) 5 and 5

4. Amylopectin is composed of **(2019 Main, 10 April I)**

(a) β-D-glucose, C_1-C_4 and C_2-C_6 linkages
(b) α-D-glucose, C_1-C_4 and C_2-C_6 linkages
(c) β-D-glucose, C_1-C_4 and C_1-C_6 linkages
(d) α-D-glucose, C_1-C_4 and C_1 -C_6linkages

5. The peptide that gives positive ceric ammonium nitrate and carbylamine tests is **(2019 Main, 09 April II)**

(a) Lys-Asp (b) Ser-Lys
(c) Gln-Asp (d) Asp-Gln

6. Which of the following statement is not true about sucrose?
(2019 Main, 09 April I)

(a) It is also named as invert sugar.
(b) The glycosidic linkage is present between C_1 of α-glucose and C_1 of β-fructose
(c) It is a non-reducing sugar
(d) On hydrolysis, it produces glucose and fructose

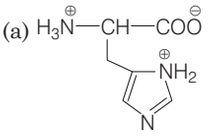
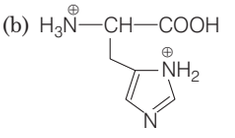
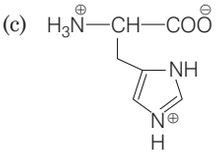
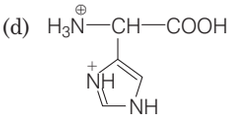
7. Fructose and glucose can be distinguished by
(2019 Main, 08 April II)

(a) Fehling's test (b) Barfoed's test
(c) Benedict's test (d) Seliwanoff's test

8. Maltose on treatment with dilute HCl gives
(2019 Main, 08 April I)

(a) D-glucose and D-fructose (b) D-fructose
(c) D-galactose (d) D-glucose

9. The correct structure of histidine in a strongly acidic solution ($pH = 2$) is **(2019 Main, 12 Jan II)**

(a) 
(b) 
(c) 
(d) 

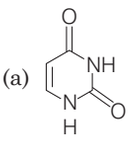
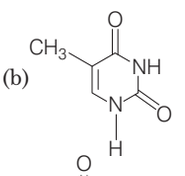
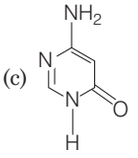
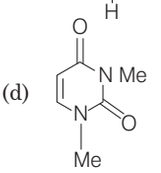
10. The correct match between Item I and Item II is

Item I	Item II
A. Ester test	P. Tyr
B. Carbylamine test	Q. Asp
C. Phthalein dye test	R. Ser
	S. Lys

(2019 Main, 11 Jan II)

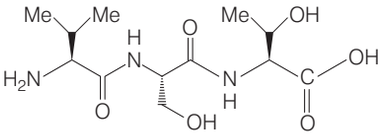
(a) $A \rightarrow Q; B \rightarrow S; C \rightarrow R$ (b) $A \rightarrow R, B \rightarrow Q; C \rightarrow P$
(c) $A \rightarrow R; B \rightarrow S;\ C \rightarrow Q$ (d) $A \rightarrow Q; B \rightarrow S; C \rightarrow P$

11 Among the following compounds, which one is found in RNA? **(2019 Main, 11 Jan I)**

(a) 
(b) 
(c) 
(d) 

12. Which of the following tests cannot be used for identifying amino acids ? **(2019 Main, 10 Jan II)**
(a) Barfoed test (b) Ninhydrin test
(c) Xanthoproteic test (d) Biuret test

13. The correct sequence of amino acids present in the tripeptide given below is **(2019 Main, 9 Jan II)**

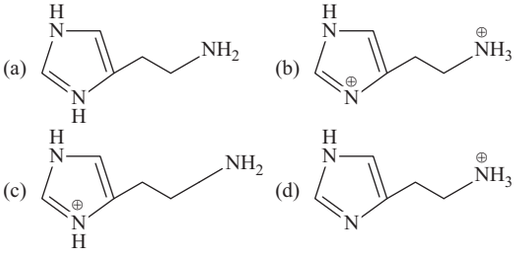


(a) Thr - Ser - Leu (b) Leu - Ser - Thr
(c) Val - Ser - Thr (d) Thr - Ser - Val

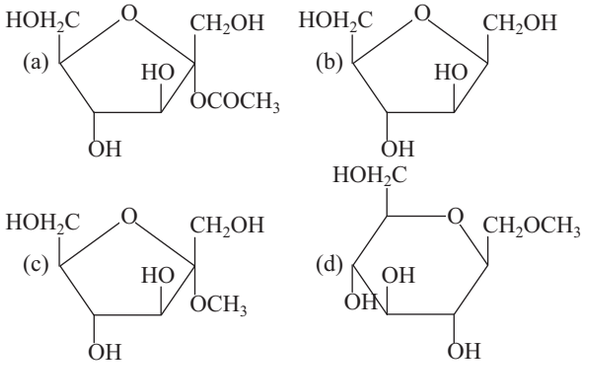
14 The increasing order of pK_a of the following amino acids in] aqueous solution is Gly, Asp, Lys, Arg **(2019 Main, 9 Jan I)**
(a) Asp < Gly < Arg < Lys (b) Arg < Lys < Gly < Asp
(c) Gly < Asp < Arg < Lys (d) Asp < Gly < Lys < Arg

15. Glucose on prolonged heating with HI gives **(2018 Main)**
(a) *n*-hexane (b) 1-hexene
(c) Hexanoic acid (d) 6-iodohexanal

16. The predominant form of histamine present in human blood is (pK_a, Histidine = 6.0) **(2018 Main)**



17. Which of the following compounds will behave as a reducing sugar in an aqueous KOH solution? **(2017 Main)**



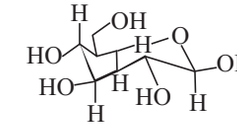
18. Thiol group is present in **(2016 Main)**
(a) cystine (b) cysteine
(c) methionine (d) cytosine

19. Which of the vitamins given below is water soluble?
(a) Vitamin C (b) Vitamin D **(2015 Main)**
(c) Vitamin E (d) Vitamin K

20. Which one of the following bases is not present in DNA?
(a) Quinoline (b) Adenine **(2014 Main)**
(c) Cytosine (d) Thymine

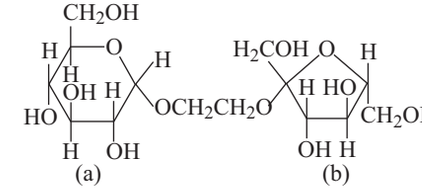
21. Synthesis of each molecule of glucose in photosynthesis involves **(2013 Main)**
(a) 18 molecules of ATP (b) 10 molecules of ATP
(c) 8 molecules of ATP (d) 6 molecules of ATP

22. The following carbohydrate is



(2011)
(a) a ketohexose (b) an aldohexose
(c) an α-furanose (d) an α-pyranose

23. The correct statement about the following disaccharide is



(2010)
(a) Ring (a) is pyranose with α-glycosidic link
(b) Ring (a) is furanose with α-glycosidic link
(c) Ring (b) is furanose with α-glycosidic link
(d) Ring (b) is pyranose with β-glycosidic link

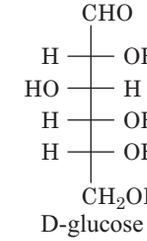
24. Two forms of D-glucopyranose, are called **(2005, 1M)**
(a) enantiomers (b) anomers
(c) epimers (d) diastereomers

25. Which of the following pairs give positive Tollen's test ? **(2004, 1M)**
(a) Glucose, sucrose (b) Glucose, fructose
(c) Hexanal, acetophenone (d) Fructose, sucrose

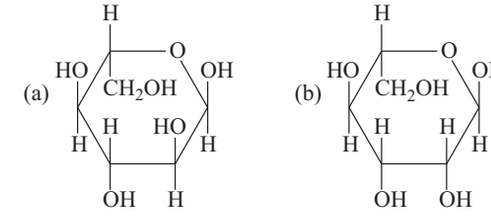
Objective Question II

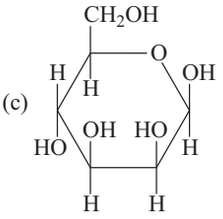
(One or more than one correct option)

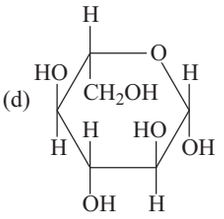
26. The Fischer presentation of D-glucose is given below.



The correct structure(s) of β-L-glucopyranose is (are) **(2018 Adv.)**



(c) 

(d) 

27. For 'invert sugar', the correct statement(s) is (are)

(Given: specific rotations of (+) - sucrose, (+) - maltose, L-(−) -glucose and L-(+) -fructose in aqueous solution are +66°, +140°, − 52° and 92° , respectively) **(2016 Adv.)**

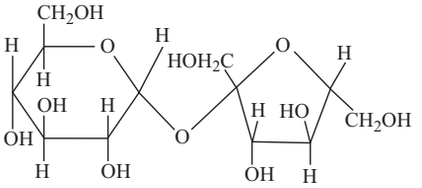
(a) Invert sugar is prepared by acid catalysed hydrolysis of maltose

(b) Invert sugar is an equimolar mixture of D-(+) -glucose and D-(–)- fructose

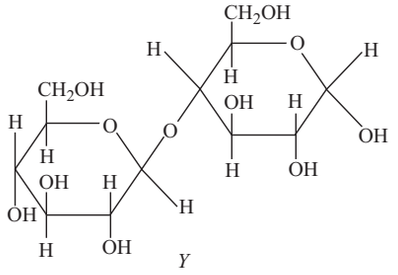
(c) Specific rotation of invert sugar is − 20°

(d) On reaction with Br_2 water, invert sugar forms saccharic acid as one of the products

28. The correct statement(s) about the following sugars *X* and *Y* is/are: **(2009)**



X



Y

(a) *X* is a reducing sugar and *Y* is a non-reducing sugar

(b) *X* is a non-reducing sugar and *Y* is a reducing sugar

(c) The glucosidic linkages in *X* and *Y* are α and β, respectively

(d) The glucosidic linkages in *X* and *Y* are β and α, respectively

Assertion and Reason

Read the following questions and answer as per the direction given below :

(a) Statement I is correct; Statement II is correct; Statement II is a correct explanation of Statement I.

(b) Statement I is correct; Statement II is correct; Statement II is not the correct explanation of Statement I.

(c) Statement I is correct; Statement II is incorrect.

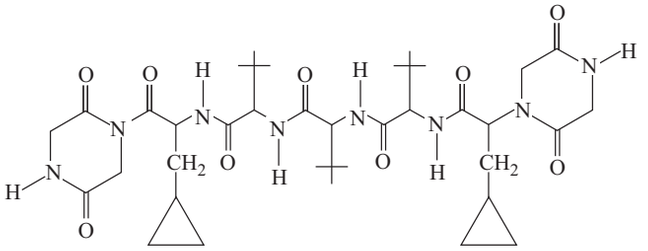
(d) Statement I is incorrect; Statement II is correct.

29. **Statement I** Glucose gives a reddish-brown precipitate with Fehling's solution.

Statement II Reaction of glucose with Fehling's solution gives CuO and gluconic acid. **(2007, 3M)**

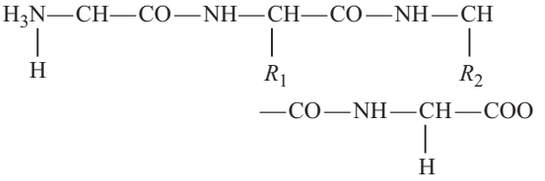
Integer Answer Type Questions

30. The total number of distinct naturally occurring amino acids obtained by complete acidic hydrolysis of the peptide shown below is **(2014 Adv.)**



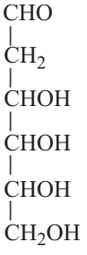
31. A tetrapeptide has — COOH group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with $-NH_2$ group attached to a chiral centre is **(2013 Adv.)**

32. The substituents R_1 and R_2 for nine peptides are listed in the table given below. How many of these peptides are positively charged at pH = 7.0 ? **(2012)**



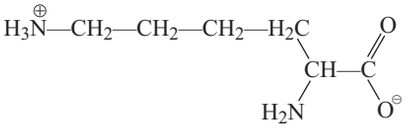
Peptide	R_1	R_2
I	H	H
II	H	CH_3
III	CH_2COOH	H
IV	CH_2CONH_2	$(CH_2)_4NH_2$
V	CH_2CONH_2	CH_2CONH_2
VI	$(CH_2)_4NH_2$	$(CH_2)_4NH_2$
VII	CH_2COOH	CH_2CONH_2
VIII	CH_2OH	$(CH_2)_4NH_2$
IX	$(CH_2)_4NH_2$	CH_3

33. When the following aldohexose exists in its D-configuration, the total number of stereoisomers in its pyranose form, is **(2012)**



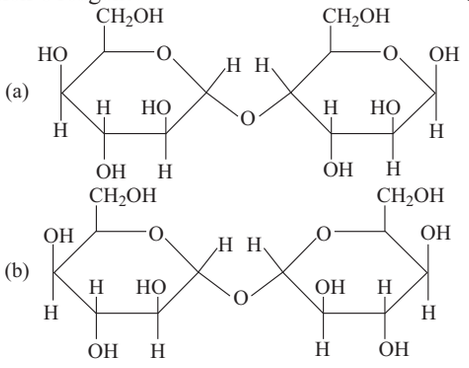
34. A decapeptide (Molecular weight 796) on complete hydrolysis gives glycine (Molecular weight 75), alanine and phenylalanine. Glycine contributes 47.0% to the total weight of the hydrolysed products. The number of glycine units present in the decapeptide is **(2011)**

35. The total number of basic groups in the following form of lysine is **(2010)**

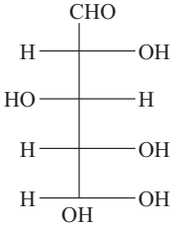


Subjective Questions

36. Which of the following disaccharide will not reduce Tollen's reagent? **(2005, 2M)**

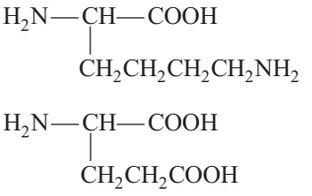


37. The structure of D-glucose is as follows :

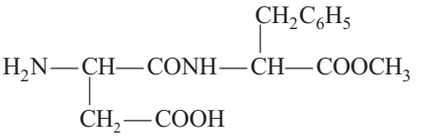


(i) Draw the structure of L-glucose.
(ii) Give the reaction of L-glucose with Tollen's reagent.
(2004, 2M)

38. Following two amino acids lysine and glutamine form dipeptide linkage. What are two possible dipeptides?
(2003, 2M)



39. Aspartame, an artificial sweetener, is a peptide and has the following structure



(i) Identify the four functional groups.
(ii) Write the Zwitter ionic structure.
(iii) Write the structures of the amino acids obtained from the hydrolysis of aspartame.
(iv) Which of the two amino acids is more hydrophobic?
(2001, 5M)

40. Give the structures of the products in the following reaction

$$\text{Sucrose} \xrightarrow{H^+} A + B$$
(2000, 2M)

41. Write the structure of alanine at pH = 2 and pH = 10.
(2000, 2M)

Topic 2 Chemistry in Everyday Life

Objective Questions I (Only one correct option)

1. Which of the following is a thermosetting polymer?
(2019 Main, 12 April I)

(a) Bakelite (b) Buna-N
(c) Nylon-6 (d) PVC

2. The correct match between **Item**-I and **Item**-II is

	Item-I		Item-II
A.	High density polythene	I.	Peroxide catalyst
B.	Polyacrylonitrile	II.	Condensation at high temperature and pressure
C.	Novolac	III.	Ziegler-Natta catalyst
D.	Nylon-6	IV.	Acid or base catalyst

(2019 Main, 10 April II)

Codes

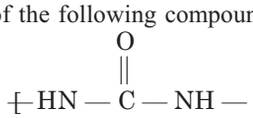
	A	B	C	D		A	B	C	D
(a)	III	I	IV	II	(b)	IV	II	I	III
(c)	II	IV	I	III	(d)	III	I	II	IV

3. Which of the following is a condensation polymer?
(2019 Main, 10 April I)

(a) Nylon-6, 6 (b) Neoprene
(c) Teflon (d) Buna - S

4. Noradrenaline is a/an

(a) antidepressant (b) antihistamine
(c) neurotransmitter (d) antacid
(2019 Main, 9 April II)

5. Which of the following compounds is a constituent of the polymer  ?
(2019 Main, 9 April II)

(a) N-methyl urea
(b) Methylamine
(c) Ammonia
(d) Formaldehyde

6. The structure of nylon-6 is

(a) 
(b) 
(c) 
(d) 

(2019 Main, 8 April II)

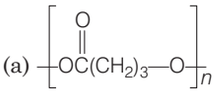
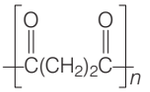
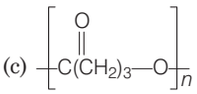
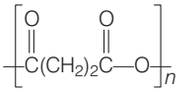
7. The two monomers for the synthesis of nylon 6, 6 are **(2019 Main, 12 Jan II)**

(a) $HOOC(CH_2)_4COOH, H_2N(CH_2)_4NH_2$
(b) $HOOC(CH_2)_6COOH, H_2N(CH_2)_4NH_2$
(c) $HOOC(CH_2)_4COOH, H_2N(CH_2)_6NH_2$
(d) $HOOC(CH_2)_6COOH, H_2N(CH_2)_6NH_2$

8. Poly-β-hydroxybutyrate-Co-β-hydroxyvalerate (PHBV) is a copolymer of …… **(2019 Main, 12 Jan I)**

(a) 3-hydroxybutanoic acid and 2-hydroxypentanoic acid
(b) 2-hydroxybutanoic acid and 3-hydroxypentanoic acid
(c) 3-hydroxybutanoic acid and 4-hydroxypentanoic acid
(d) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid

9. The homopolymer formed from 4-hydroxybutanoic acid is

(a) 
(b) 
(c) 
(d) 

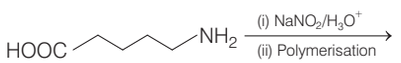
(2019 Main, 11 Jan II)

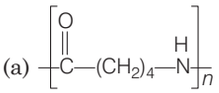
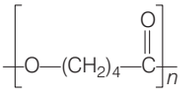
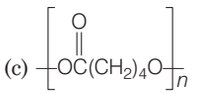
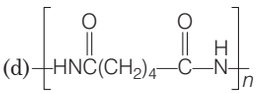
10. The correct match between Item I and Item II is

	Item I		Item II
A.	Allosteric effect	P.	Molecule binding to the active site of enzyme.
B.	Competitive inhibitor	Q.	Molecule crucial for communication in the body.
C.	Receptor	R.	Molecule binding to a site other than the active site of enzyme.
D.	Poison	S.	Molecule binding to the enzyme covalently.

(a) A → P; B → R; C → S; D → Q
(b) A → P, B → R; C → Q; D → S
(c) A → R; B → P; C → S; D → Q
(d) A → R; B → P; C → Q; D → S **(2019 Main, 11 Jan II)**

11. The polymer obtained from the following reaction is: **(2019 Main, 11 Jan I)**



(a) 
(b) 
(c) 
(d) 

12. The correct match between item (I) and item (II) is

	Item - I		Item - II
(A)	Norethindrone	(P)	Antibiotic
(B)	Ofloxacin	(Q)	Antifertility
(C)	Equanil	(R)	Hypertension
		(S)	Analgesics

(2019 Main, 11 Jan I)

(a) (A) → (Q); (B) → (R); (C) → (S)
(b) (A) → (Q); (B) → (P); (C) → (R)
(c) (A) → (R); (B) → (P); (C) → (S)
(d) (A) → (R); (B) → (P); (C) → (R)

13. The correct match between Item - I and Item - II is

	Item I (Drug)		**Item** II (Test)
A.	Chloroxylenol	P.	Carbylamine test
B.	Norethindrone	Q.	Sodium hydrogen carbonate test
C.	Sulphapyridine	R.	Ferric chloride test
D.	Penicillin	S.	Bayer's test

(2019 Main, 9 Jan I)

(a) A → R ; B → P ; C → S ; D → Q
(b) A → R ; B → S ; C → P ; D → Q
(c) A → Q ; B → P ; C → S ; D → R
(d) A → Q ; B → S ; C → P ; D → R

14. The formation of which of the following polymers involves hydrolysis reaction? **(2017 Main)**

(a) Nylon-6
(b) Bakelite
(c) Nylon-6, 6
(d) Terylene

15. Which of the following statements about low density polythene is false? **(2016 Main)**

(a) It is a poor conductor of electricity
(b) Its synthesis required dioxygen or a peroxide initiator as a catalyst
(c) It is used in the manufacture of buckets, dustbins etc.
(d) Its synthesis requires high pressure

16. Which of the following is an anionic detergent? **(2016 Main)**

(a) Sodium lauryl sulphate
(b) Cetyltrimethyl ammonium bromide
(c) Glyceryl oleate
(d) Sodium stearate

17. On complete hydrogenation, natural rubber produces **(2016 Adv.)**

(a) ethylene-propylene copolymer
(b) vulcanised rubber
(c) polypropylene
(d) polybutylene

18. Which polymer is used in the manufacture of paints and lacquers? **(2015 Main)**

(a) Bakelite
(b) Glyptal
(c) Polypropene
(d) Polyvinyl chloride

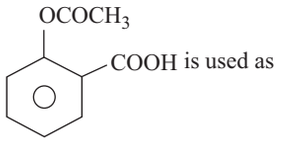
19. Match the polymers in Column I with their main uses in Column II and choose the correct answer:

	Column I		Column II
(A)	Polystyrene	1.	Paints and lacquers
(B)	Glyptal	2.	Raincoats
(C)	Polyvinyl chloride	3.	Manufacture of toys
(D)	Bakelite	4.	Computer discs

Codes

	A	B	C	D
(a)	2	1	3	4
(c)	2	4	3	1

	A	B	C	D
(b)	3	1	2	4
(d)	3	4	2	1

20. 

is used as

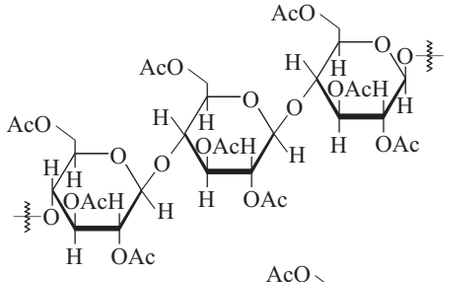
(a) Insecticide (b) Antihistamine
(c) Analgesic (d) Antacid

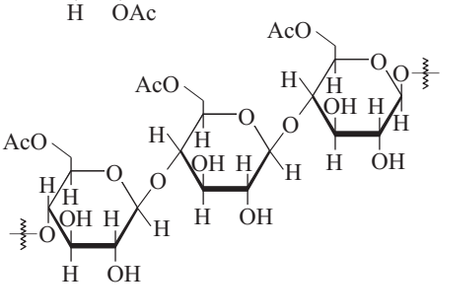
21. Which of the following is not an antacid? **(2015 Main)**
(a) Aluminium hydroxide (b) Cimetidine
(c) Phenelzine (d) Ranitidine

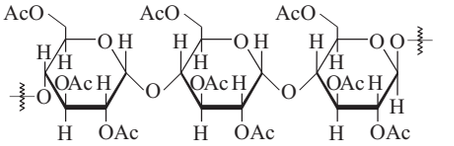
22. Which one is classified as a condensation polymer? **(2014 Main)**
(a) Dacron (b) Neoprene
(c) Teflon (d) Acrylonitrile

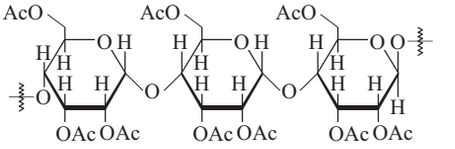
23. Among cellulose, poly (vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is **(2009)**
(a) nylon
(b) poly (vinyl chloride)
(c) cellulose
(d) natural rubber

24. Cellulose upon acetylation with excess acetic anhydride/H_2SO_4 (catalytic) gives cellulose triacetate whose structure is **(2008, 3M)**

(a) 

(b) 

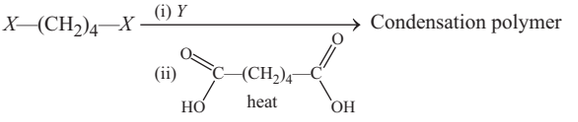
(c) 

(d) 

Objective Question II
(One or more than one correct option)

25. Under hydrolysis conditions, the compounds used for preparation of linear polymer and for chain termination, respectively are **(2012)**
(a) CH_3SiCl_3 and $Si(CH_3)_4$ (b) $(CH_3)_2SiCl_2$ and $(CH_3)_3SiCl$
(c) $(CH_3)SiCl_2$ and CH_3SiCl_3 (d) $SiCl_4$ and $(CH_3)_3SiCl$

26. The correct functional group X and the reagent/reaction conditions Y in the following schemes are **(2011)**



(a) $X = COOCH_3$, $Y = H_2$/Ni/heat
(b) $X = CONH_2$, $Y = H_2$/Ni/heat
(c) $X = CONH_2$, $Y = Br_2$/NaOH
(d) $X = CN$, $Y = H_2$/Ni/heat

Match the Columns

27. Match the chemical substances in Column I with type of polymers/type of bond in Column II. **(2007, 6M)**

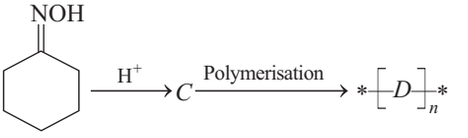
	Column I		Column II
A.	Cellulose	p.	Natural polymer
B.	Nylon-66	q.	Synthetic polymer
C.	Protein	r.	Amide linkage
D.	Sucrose	s.	Glycoside linkage

Subjective Questions

28. Monomer A of a polymer on ozonolysis yields two moles of HCHO and one mole of CH_3COCHO. **(2005)**
(a) Deduce the structure of A.
(b) Write the structure of 'all *cis*' – form of polymer of compound A.

29. Name the heterogeneous catalyst used in the polymerisation of ethylene. **(2003)**

30. Give the structures of the products in the following reaction. **(2000, 2M)**



Answers

Topic 1

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

Topic 2

1. (a)	**2.** (a)	**3.** (a)	**4.** (c)
5. (d)	**6.** (b)	**7.** (c)	**8.** (d)
9. (c)	**10.** (d)	**11.** (b)	**12.** (b)
13. (b)	**14.** (a)	**15.** (c)	**16.** (a)
17. (a)	**18.** (b)	**19.** (b)	**20.** (c)
21. (c)	**22.** (a)	**23.** (d)	**24.** (a)
25. (b)	**26.** (a, b, c, d)		

27. A → p, s; B → q, r; C → p, r; D → s

Hints & Solutions

Topic 1 Biomolecules

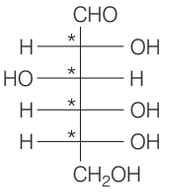
1. Statement (a) is incorrect. Glycogen is not a straight chain polymer similar to amylose. It is highly branched structure similar to amylopectin. It is known to be the storage material of animals. It is found in liver, muscles and brain. It breaks down to glucose by the action of enzymes when body needs a glucose. It is also found in yeast and fungi.

2. RNA does not have double stranded α-helix structure. Helixes present in RNA are single-stranded but sometimes they fold back on themselves to form a double helix structure. RNA usually does not replicate.

It is present in the nucleus of the cell. It controls the synthesis of protein. RNA molecules are of three types, i.e. messenger's RNA (*m*-RNA), ribosomal RNA (*r*RNA), transfer RNA (*t*-RNA).

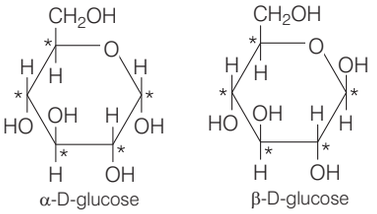
3. **Key Idea** Chiral centre is also called stereo-centre or stereogenic center.

Linear structure of glucose is as follows :



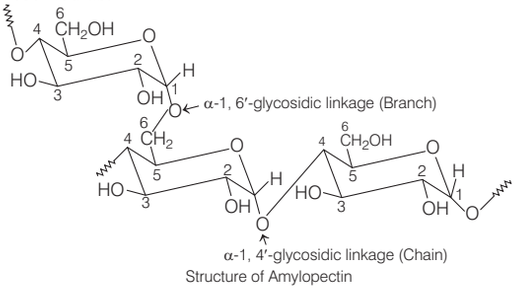
Fischer formula Number of stereo-centre (C^*) = 4.

Cyclic structure of glucose are as follows :



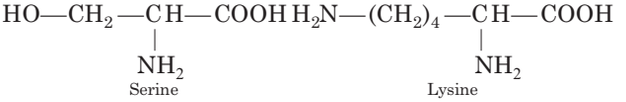
Haworth formula Number of stereo-centre (C^*) in each anomer = 5.

4. Amylopectin is the water-soluble component of starch. It is a branched-chain polymer of α-D-glucose. The main chain consists of an α – l, 4′- glycosidic linkages between α - D- α - D- glucose units and the branches are connected to the main chain by α - l,6′- glycosidic linkages. Its structure can be represented as:

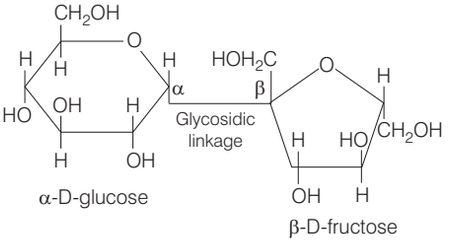


Structure of Amylopectin

5. The peptide that gives positive cerric ammonium nitrate and carbylamine tests is ser - lys. The structures of serine and lysine are,



6. Statement-(b) is not true for sucrose. It is linked through a glycosidic linkage between C-1 of α-glucose and C-2 of β-fructose. Since, the reducing groups of glucose and fructose are involved in glycosidic bond formation, sucrose is a non-reducing sugar.



On hydrolysis with acids or enzyme, sucrose gives equimolar mixture of D-(+)-glucose and D-(–)-fructose.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{HCl} \underset{\text{D-(+)-glucose}}{C_6H_{12}O_6} + \underset{\text{D-(–)-fructose}}{C_6H_{12}O_6}$$

7. Both fructose and glucose give following test positive.

(i) Fehling's test (red ppt. of Cu_2O is obtained).

(ii) Barfoed's test (red ppt. of Cu_2O is obtained)

(iii) Benedict's test (red ppt. of Cu_2O is obtained)

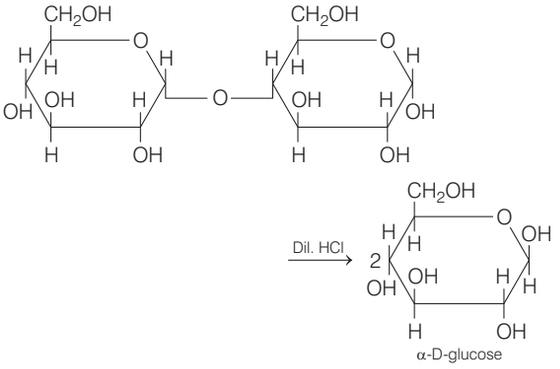
Fehling's solution : $CuSO_4$ + Na, K-tartrate (Rochelle salt)

Barfoed's reagent $(CH_3COO)_2Cu + CH_3COOH + H_2O$ (7%) (1%) (92%)

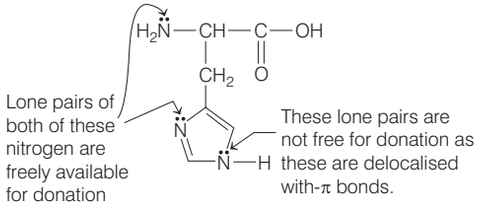
Benedict's solution : $CuSO_4$ + Na-citrate + Na_2CO_3

Seliwanoff's test is used to differentiate between ketose and aldose. The reagent is a solution of resorcinol in concentrated HCl. The reagent when heated along with a sugar will produce furfural or hydroxy-methylfurfural, which further reacts to give red color. Ketose (fructose) reacts more quickly than aldose (glucose).

8. Maltose on treatment with dil. HCl gives D-glucose. Hydrolysis of maltose yields two moles of α- D-glucose. Thus, it is composed of two α-D-glucose units in which C-1 of one glucose unit (I) is linked to C-4 of another glucose unit (II). The free aldehyde group can be produced at C-1 of second glucose in solution and it shows reducing properties. So, it is a reducing sugar.

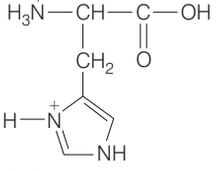


9. Histidine has following structure in



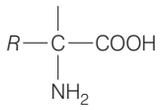
At highly acidic pH, i.e. 2 both the nitrogens with lone pairs will accept one H^+ each and $-\overset{\|}{\underset{O}{C}}-OH$ will not loose its H^+. Thus,

the final structure of histidine at pH = 2 will be



Thus, option (d) is the correct answer.

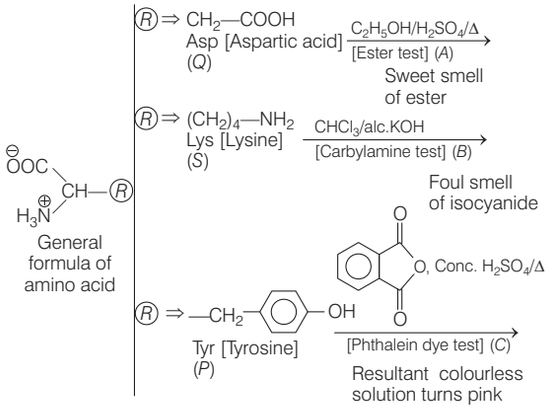
Note Amino acids have following generalise structure:



They have the tendency to loose H^+ of their —COOH group at alkaline (higher) pH while the $-NH_2$ group present in them have the tendency to gain H^+ at acidic (lower) pH.

10. The correct match is :

A → (Q); (B) → (S) (C) → (P)

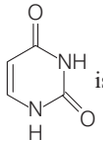


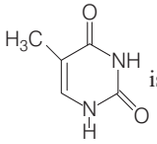
(A) Ester test confirms the presence of —COOH group.

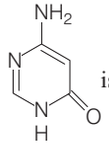
(B) Carbylamine test confirms the presence of $-NH_2$ group (1°).

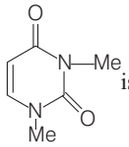
(C) Phthalein dye test confirms the presence of phenolic —OH group.

11. RNA contains, adenine (A), guanine (G), cytosine (C) and uracil (U). In the given options,

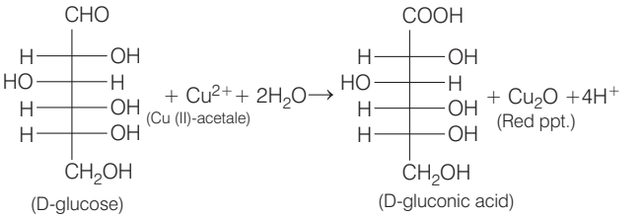

is uracil (present in RNA only)


is thymine (present in DNA)

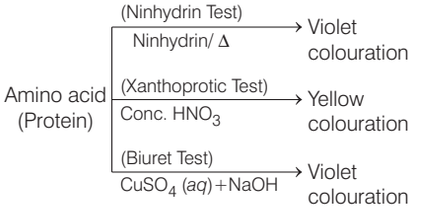

is cytosine (present in both DNA and RNA)


is not a pyrimidine base but a derivative of uracil.

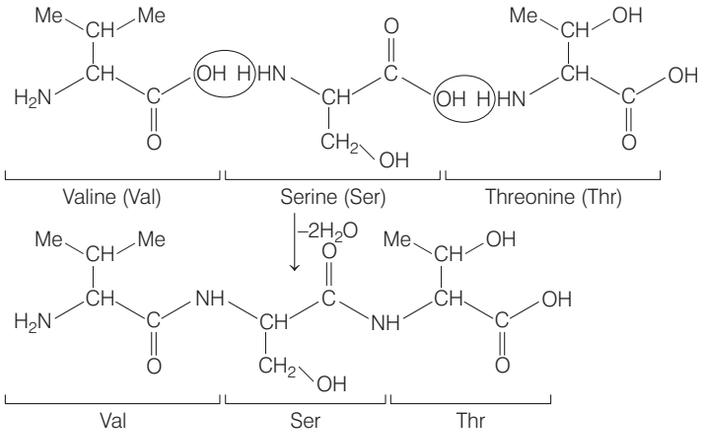
12. (i) Barfoed test is used for detecting the presence of monosaccharides like glucose, fructose etc. Barfoed reagents is Cu (II) acetate solution.



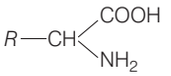
(ii)



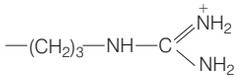
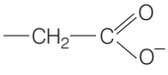
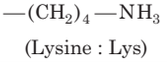
13. Formation of the tripeptide (Val-Ser-Thr) can be shown as:



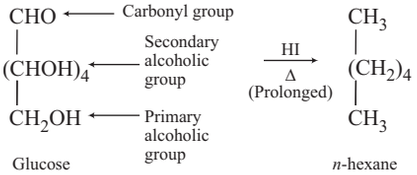
14 Amino acid molecules can be represented as,



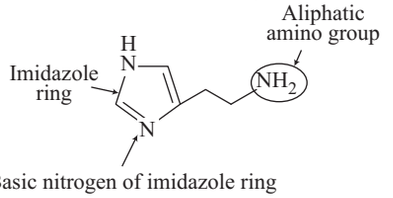
Nature of the '*R*' group will determine the basicity (hence, pK_a) of an amino acid.

	'*R*' in the amino group	**Nature of *R***	**Nature of the amino acids**
1.	 (Arginine : Arg)	Basic	More basic (due to the presence of acetamidine group)
2.	 (Aspartic acid: Asp)	Acidic	Acidic
3.	—H (Glycine) : Gly	Neutral	Neutral
4.	 (Lysine : Lys)	Basic	Basic

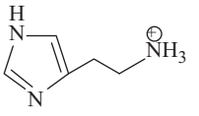
15. HI is a strong reducing agent. It reduces both primary and secondary alcoholic groups of glucose along with the carbonyl group to produce *n*-hexane as



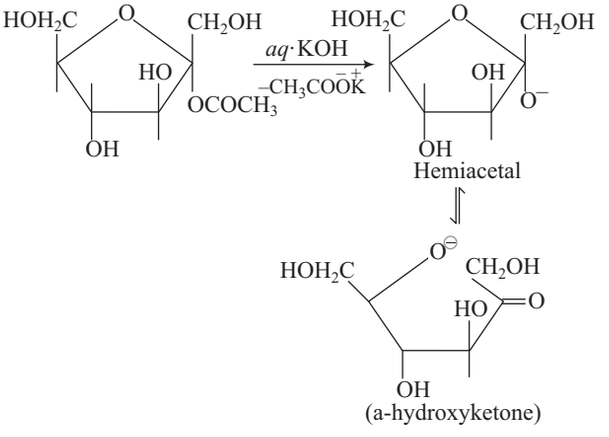
16. Our blood is slightly basic in nature with pH range from 7.35-7.4. The structure of histamine is given below :



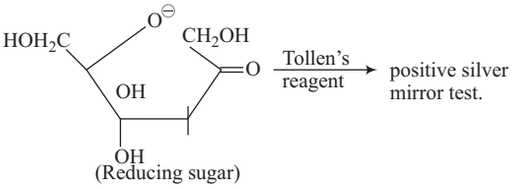
It is produced by decarboxylation of histidine having following structure. It is clearly visible from the above structure that histamine has two basic centres namely aliphatic amino group and basic nitrogen of imidazole ring. The aliphatic amino group has pK_a around 9.4. In blood with pH around 7.4 the aliphatic amino group of histamine become protonated to give a single charged cation as shown below



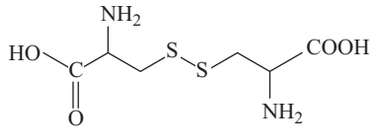
17. Sugars that have an aldehyde, a ketone, a hemiacetal or a hemiketal group is able to reduce an oxidising agent. These sugars are classified as reducing sugars.

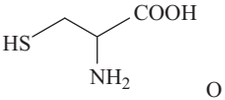


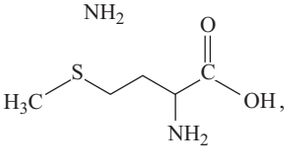
Hemiacetal can be easily reduced by oxidising agent such as Tollen's reagent.

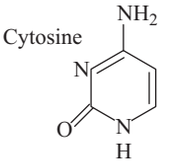


18.

Cystine 

Cysteine 

Methionine 

Cytosine 

Thiol group (SH) is present in cysteine.

19. Vitamin B and C are water soluble while vitamin A,D,E and K are fat soluble or water insoluble.

20. Quinoline is an alkaloid, it is not present in DNA. DNA has four nitrogen bases in adenine, guanine, cytosine and thymine.

21. 18 ATPs are involved in the formation of 1 glucose molecule as shown in the reaction below :

$$6CO_2 + 12NADPH + 18\ ATP \longrightarrow C_6H_{12}O_6 + 12NADP + 18\ ADP$$

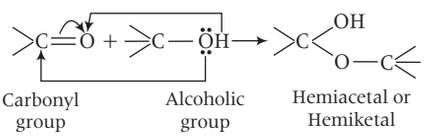
22. Here, the — OH of hemiacetal group is equatorial therefore, it is a β-pyranose of an aldohexose.

23. The six-membered cyclic ether is known as pyranose while the five membered cyclic ether is known as furanose. Hence, ring (a) is a pyranose and it has ether linkage at α-position that is known as α-glycosidic linkage in carbohydrate chemistry.

24. "α" and "β" cyclic hemiacetals of D-glucose having difference in configuration at C-1 only are called anomers.

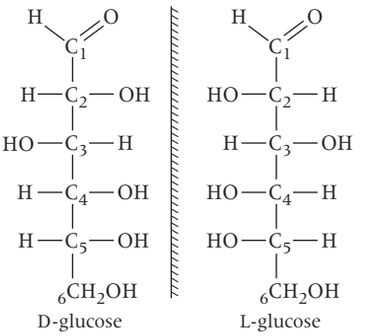
25. Both glucose and fructose are reducing sugars, reduces Tollen's reagent to metallic silver.

26. (d) A pyranose ring is a 6 membered ring having 5 carbon atoms and one oxygen atom. In glucose, it is formed by the reaction between >C=O group at position 1 and —OH group at 5th carbon atom. In general reaction between >C=O group and >C—OH looks like

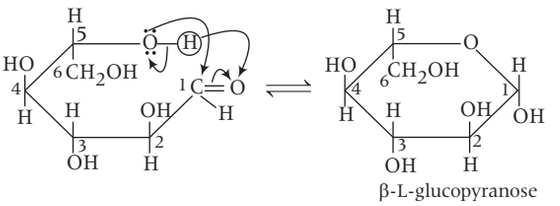


The product formed in called **hemiacetal**

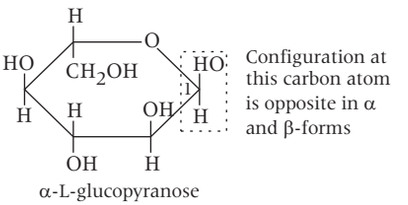
(if>C=O group belongs to an aldehyde) or **hemiketal** (if >C=O group belongs to a ketone). L- glucose has the mirror image configuration of D-glucose i.e.,



So, β-L glucopyranose is formed as



The α-L-glucopyranose has configurational change at C_1 only and looks like



27. If there is inversion of specific rotation from (+) to (−), then invert sugar is formed.

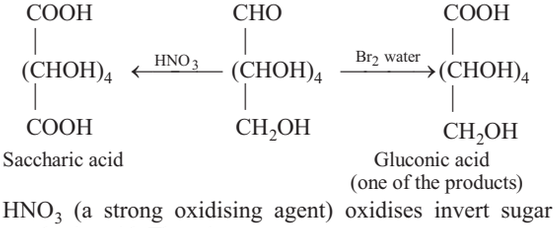
(a) $C_{12}H_{22}O_{11} + H_2O \longrightarrow$ Glucose
(+)Maltose 140° ; D(+) 52°

(b) $C_{12}H_{22}O_{11} + H_2O \longrightarrow$ Glucose + Fructose
(+)Sucrose + 66° ; D(+) 52° ; L(−) −92°
−40° for 2 moles mixture
−20° for 1 mole mixture

There is formation of invert sugar. Thus, correct.

(c) Specific rotation of invert sugar is −20° per mole. Thus, correct.

(d) Br_2 water is a weak oxidising agent. It oxidises —CHO to —COOH. —CH_2OH group is not affected.



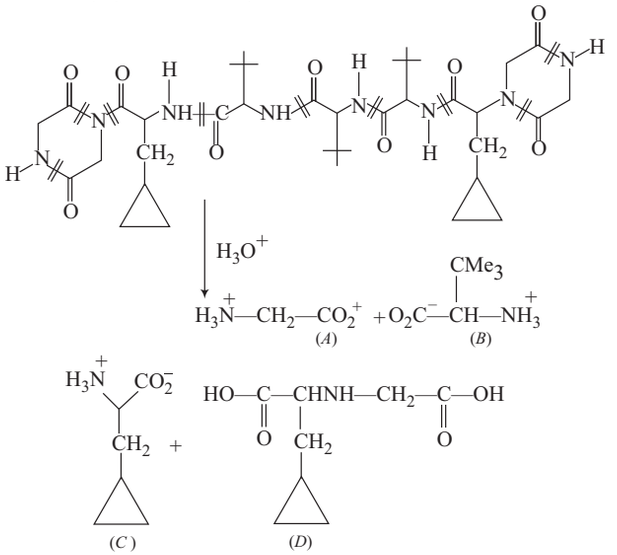
HNO_3 (a strong oxidising agent) oxidises invert sugar to saccharic acid. Thus, incorrect.

28. X is acetal, has no free hemiacetal, hence a non-reducing sugar while Y has a free hemiacetal group, it is reducing sugar. Also, glucosidic linkage of X is 'α' while that of Y is β-linkage.

29. **Statement I is correct** Presence of — CHO group in glucose is tested by Fehling's solution test where a reddish-brown precipitate of Cu_2O is formed.

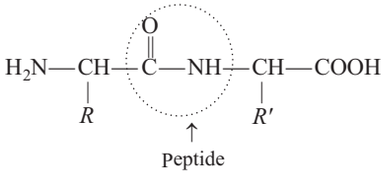
Hence, Statement II is incorrect.

30. **PLAN** This problem can be solved by performing hydrolysis of peptide and deciding the nature of product.
Chemical reaction and product formed after hydrolysis of given peptide can be represented as

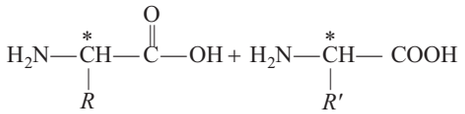


(A) is glycine which is only naturally occurring amino acid. While (B), (C) and (D) are not the naturally occurring amino acids. Hence, correct integer is (1).

31. **PLAN** A peptide linkage is hydrolysed to two free amino acids.



Peptide



C* is chiral carbon tetrapeptide has four amino acids joined by three peptide linkage.

— COOH group is on alanine part, thus it is at fixed C-terminal position in each combination.

Glycine is optically inactive thus it cannot be on the N— terminal side. Thus, possible combinations are

Phe-Gly-Val-Ala, Phe-Val-Gly-Ala,
Val-Gly-Phe-Ala, Val-Phe-Gly-Ala

Thus, in all **four combinations are possible.**

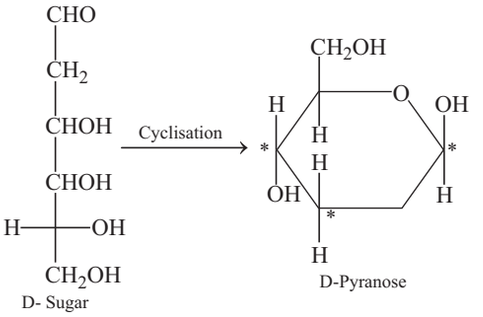
32. The amino acid remain completely in Zwitter ionic form at its isoelectric point. Amino acids with additional acidic group have their isoelectric pH less than 7.0 and increasing pH above isoelectric point makes them anionic.

On the other hand, amino acids with additional basic group have their isoelectric pH greater than 7.0 and decreasing pH below isoelectric point (by adding acid solution) makes them cationic. The given peptide with followings R_1 and R_2 are basic, will remain protonated (cationic) at pH = 7.0.

Peptide	R_1	R_2
IV	CH_2CONH_2	$(CH_2)_4NH_4$
VI	$(CH_2)_4NH_2$	$(CH_2)_4NH_4$
VIII	CH_2OH	$(CH_2)_4NH_4$
IX	$(CH_2)_4NH_2$	CH_3

Thus, 4 is the correct integer.

33. The D-form of given sugar is



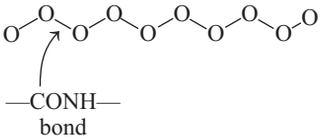
D- Sugar

D-Pyranose

Configurations at the three chiral carbons (starred) can be changed maintaining D-configuration. Hence, the total number of steroisomers of D-pyranose $= 2^3 = 8$

Thus, the correct integer is 8.

34. A decapeptide has nine peptide (amide) linkage as



—CONH—
bond

Therefore, on hydrolysis, it will absorb nine water molecules.

Hence, total mass of hydrolysis product = 796 +18 × 9 = 958

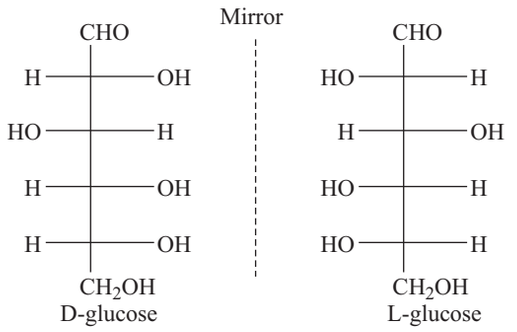
$\Rightarrow$ mass of glycine in hydrolysis product $= \frac{958 \times 47}{100} = 450$

$\Rightarrow$ number of glycine molecule in one molecule of decapeptide $= \frac{450}{75} = 6$

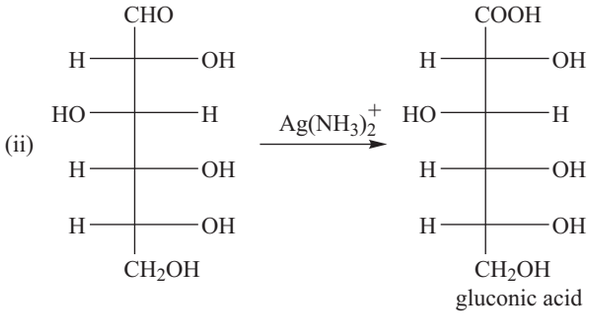
35. $—OO^-$ and $—NH_2$ are two basic groups in lysine.

36. In structure (a), one ring has a free hemiacetal group, will hydrolyse into open chain in aqueous solution and therefore will reduce Tollen's reagent. Structure (b) has only acetal groups, will not hydrolyse in aqueous solution into open chain, will not reduce Tollen's reagent

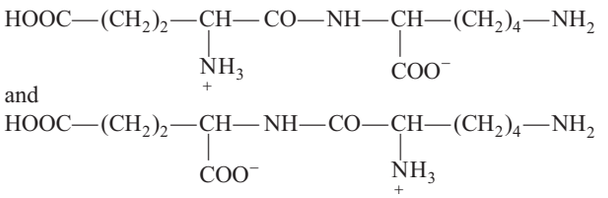
37. (i) D-glucose and L-glucose are enantiomers, hence



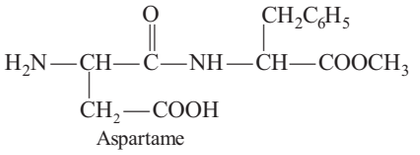
(ii)



38. The dipeptides are



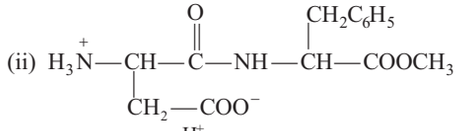
39.



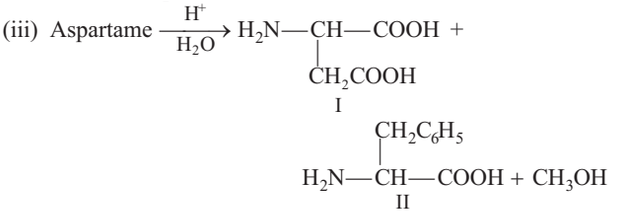
Aspartame

(i) Aspartame has amine, acid, amide and ester groups.

(ii)

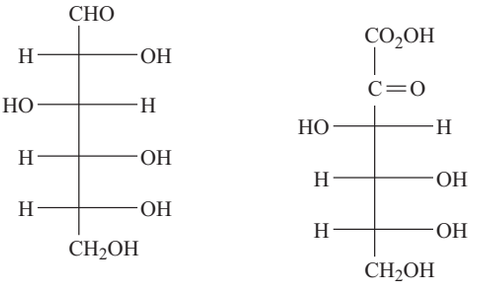


(iii)

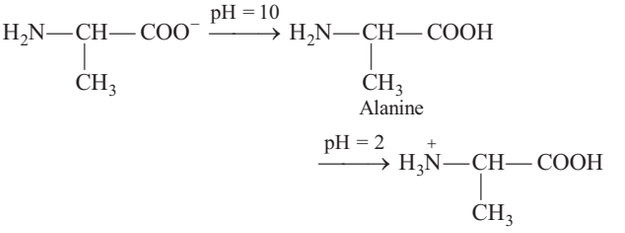


(iv) II is more hydrophobic due to the presence of phenyl group.

40. Sucrose $\xrightarrow[H_2O]{H^+}$ D-glucose + D-fructose



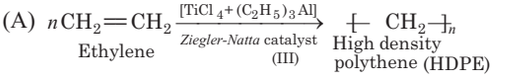
41.



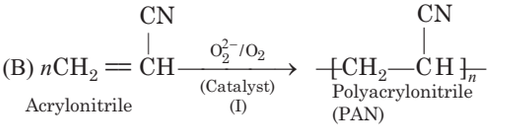
Topic 2 Chemistry in Everyday Life

1. Bakelite is a thermosetting polymer. These polymers are cross-linked or heavily branched molecules which on heating undergo extensive cross linking in moulds and become infusible. Once they get set, they cannot be reshaped and reused.

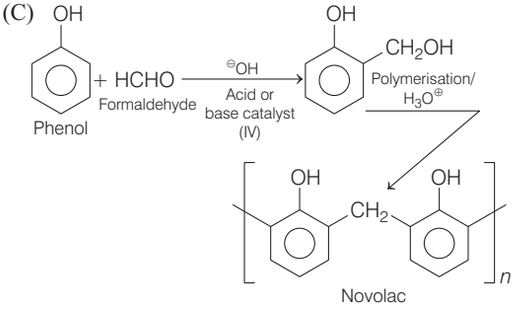
2. (A)



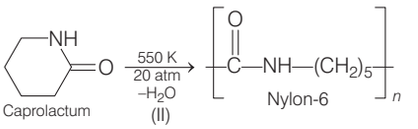
(B)



(C)



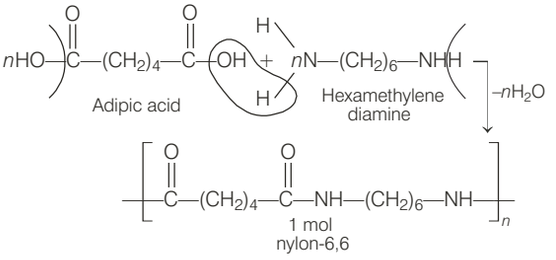
(D)



Thus, the correct match is as follows :

(A) → (III), (B) → (I), (C) → (IV), (D) → (II)

3. Nylon-6, 6 (an amide) is a condensation copolymer because it is obtained by condensation between adipic acid and hexamethylenediamine.



Neoprene, teflon and buna-S are addition polymers.

4. Noradrenaline is one of the example of neurotransmitters. It plays a major role in mood changes. If the level of noradrenaline is low for some reason, then signal-sending activity becomes low and the person suffers from depression.

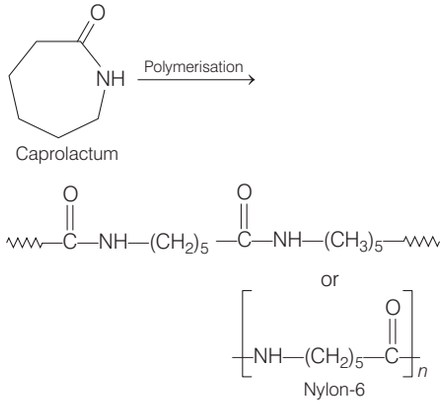
5. Monomer of $-[NH-\overset{\overset{O}{\|}}{C}-NH-CH_2]_n$ is formaldehyde. The polymer is also known as urea-formaldehyde resin. It is made from urea (NH_2CONH_2) and formaldehyde (HCHO).

$$\underset{\text{Urea}}{NH_2CONH_2} + \underset{\text{Formaldehyde}}{HCHO} \xrightarrow{\text{Polymerisation}} -(NH-\overset{\overset{O}{\|}}{C}-NH-CH_2)_n-$$

Urea-formaldehyde resin

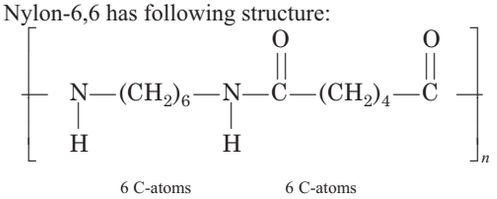
It is used for making unbreakable cups and laminated sheets.

6.

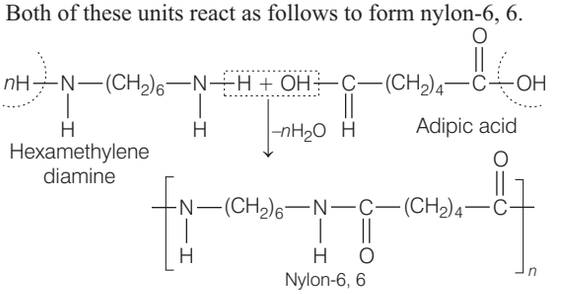


Nylon-6 is prepared by ring opening polymerisation of caprolactum. It is heated about 533 K in an inert atmospheric nitrogen about 4-5 hrs. Nylon-6 fibres are tough, possessing high tensile strength, as well as elasticity and lustre. They are wrinkle proof and highly resistant to abrasion and chemicals such as acids and alkalis.

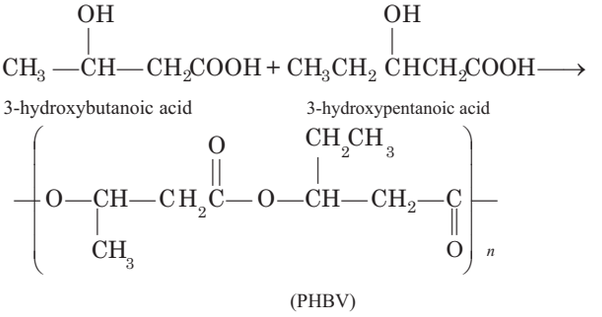
7. Nylon-6,6 has following structure:



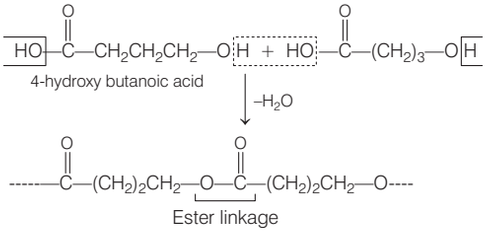
As it is a condensation polymer hence, each of its monomeric unit must contain 6 carbon atoms in them. Hence, a combination of adipic acid and hexamethylene diamine is the correct answer. Both of these units react as follows to form nylon-6, 6.



8. Poly-β-hydroxy butyrate Co-β-hydroxyvalerate (PHBV) is a copolymer of 3-hydroxybutanoic acid and 3-hydroxypentanoic acid. It is used in speciality packaging, orthopaedic devices and in controlled release of drugs. PHBV undergoes bacterial degradation in the environment. The reaction involved is as follows :



9. On polymerisation, 4-hydroxy butanoic acid will produce a condensation homopolymer by loss of H_2O molecules.



The homopolymer obtained can also be represented as

$$+\overset{\overset{O}{\|}}{C}-(CH_2)_3O+_n$$

10. (A) Molecule binding to a site other than the active site of enzyme is called allosteric effect.

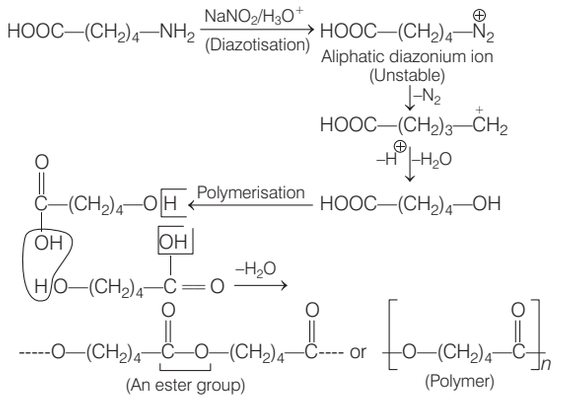
(B) Molecule binding to the active site of enzyme is called competitive inhibitor.

(C) Molecule crucial for communication in the body is called receptor.

(D) Molecule binding to the enzyme covalently is called poison.

Thus, the correct match is : A → R, B → P, C → Q, D → S

11. Given amino acid on reaction with $NaNO_2 / H_3O^+$ gives diazotisation reaction which further evolves —N_2 gas along with formation of carbocation. On further reaction with water, it form HOOC—(CH_2)—OH that undergoes polymerisation to give polymer.



12. The correct match is:

A → (Q) B → (P) C → (R)

(A) **Norethindrone** It is an antifertility drug(*Q*) containing synthetic progesterone derivative. [Other similar drug, is ethinylestradiol (novestrol)].

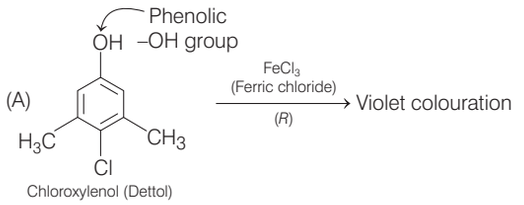
(B) **Ofloxacin** It is an antibiotic (*P*),

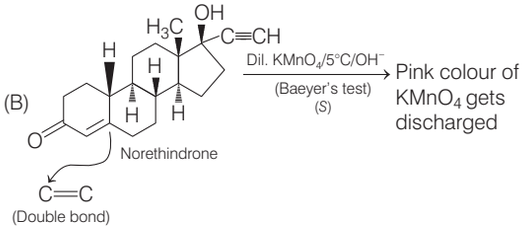
i.e produced wholly or partly by chemical synthesis with low concentration of microorganism.[Some other similar drugs : Penicillin, chloramphenicol, salvarsan etc.]

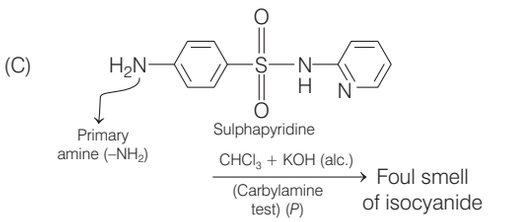
(C) **Equanil (meprobamate)** It is a mild tranquilizer for relieving hypertension. It relieve anxiety, stress, excitement by inducing a sense of well being.

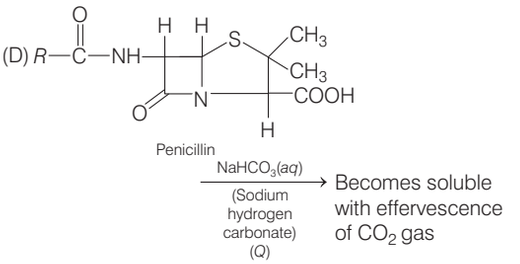
(Other similar drug is chlordiazepoxide.)

13



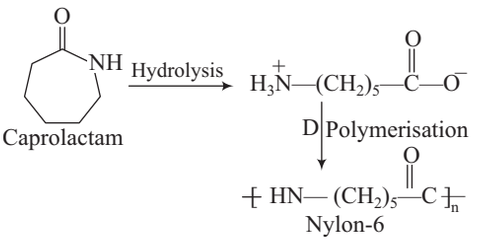






Thus, the correct match is: A → R; B → S; C → P; D → Q

14. Nylon-6 or perlon is prepared by polymerisation of amino caproic acid at high temperature. Caprolactam is first hydrolysed with water to form amino acid which on heating undergoes polymerisation to give nylon-6.



15. High density polythene is used in the manufacture of buckets, dustbins etc.

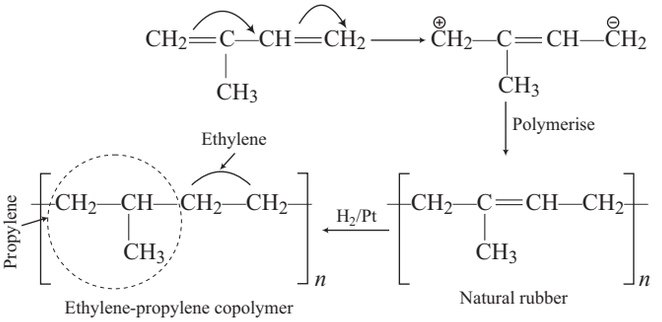
16. Sodium lauryl sulphate $[(CH_3(CH_2)_{10}CH_2OSO_3^-Na^+)]$ = Anionic detergent

Cetyltrimethyl ammonium $\left[CH_3(CH_2)_{15}-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{N}}-CH_3\right]^+ Br^-$ = Cationic detergent

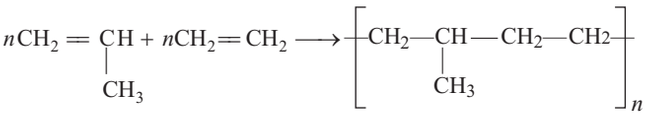
Glyceryl oleate $[(C_{17}H_{32}COO)_3C_3H_5]$ = Non-ionic detergent

Sodium stearate $[C_{17}H_{35}COO^-Na^+]$ = Anionic soap

17. Natural rubber is formed by polymerisation of isoprene.



This co-polymer is formed from propylene and ethylene.

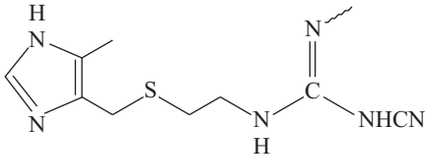


18. (a) Bakelite is used for making gears, protective coating and electrical fittings.
(b) Glyptal is used in the manufacture of paints and lacquers.
(c) PP is used in the manufacture of textile, packaging materials etc.
(d) Polyvinyl chloride (PVC) is used in the manufacture of rain coats, hand bags, leather clothes etc.

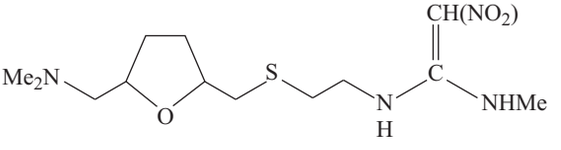
19. (a) Polystyreme- manufacturing toys (b) Glyptal- Paints and lacquers
(c) Polyvinyl chloride (PVC)- Raincoats (d) Bakelite- computer discs
Thus, the correct match is A → (1), B → (1), C → (2), D → (4)

20. The given structure is of aspirin which is used as analgesic.

21. Aluminium hydroxide $Al(OH)_3$, cimetidine and ranitidine are antacids while phenelzine is not.

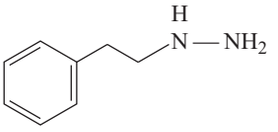


Cimetidine



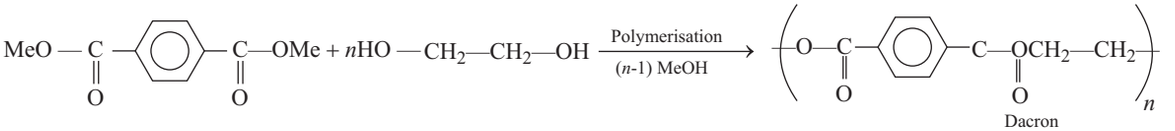
Ranitidine

Phenelzine is a tranquilizer, not an antacid.



Phenelzine is used as antidepressant drug.

22. Dacron is a condensation polymer of ethylene glycol and methyl terepthalate. Formation of dacron can be shown as

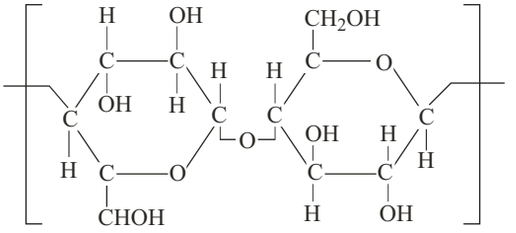


Dacron

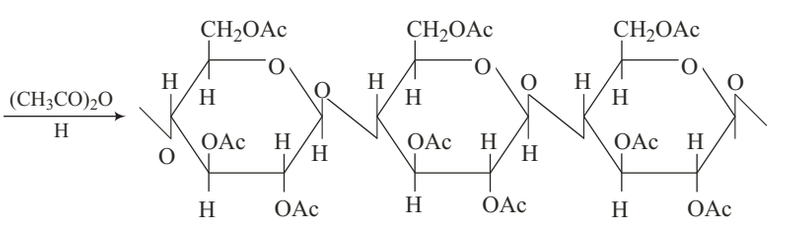
Here, elimination of MeOH occurs as a by product. So, this reaction is known as condensation polymerisation.

23. Cellulose and nylons have H-bonding type of intermolecular attraction while poly (vinyl chloride) is polar. Natural rubber is hydrocarbon and has the weakest intermolecular force of attraction, i.e. van der Waals' force of attraction.

24.

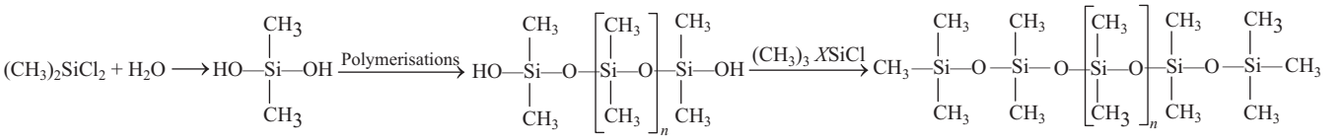


Tri-acetylated cellulose



Tri-acetylated cellulose

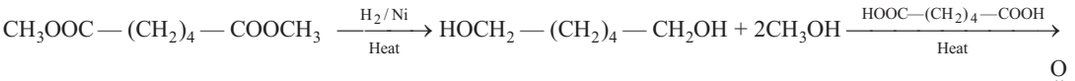
25.

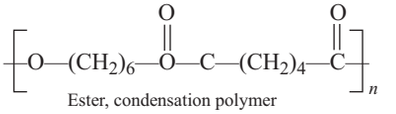


Linear chain polymer

Chain terminated linear chain silicone

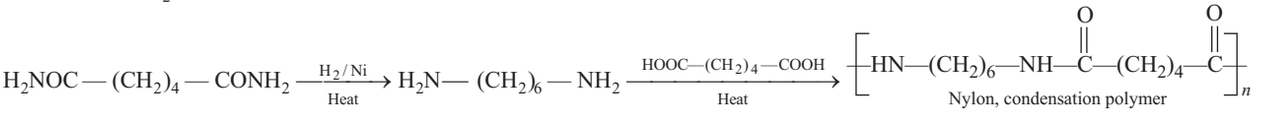
26. (a) When $X = COOCH_3$

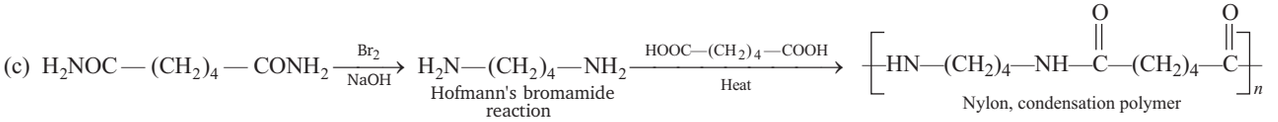


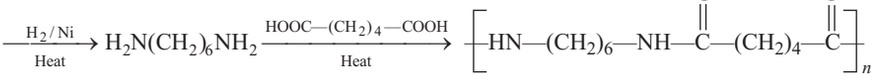


Ester, condensation polymer

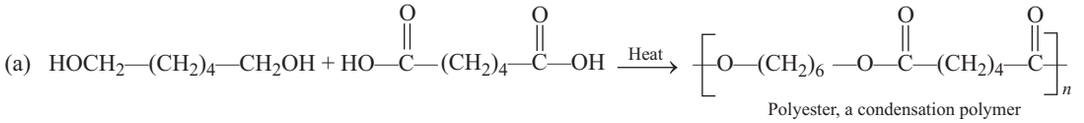
(b) When $X = CONH_2$

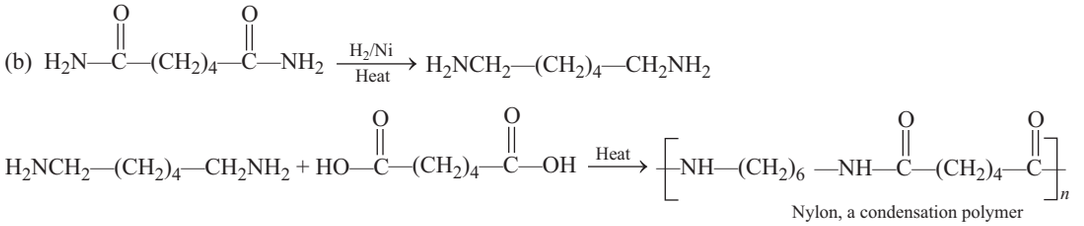


(c) 

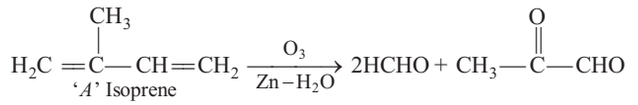
(d) When X = CN NC — $(CH_2)_4$ — CN 

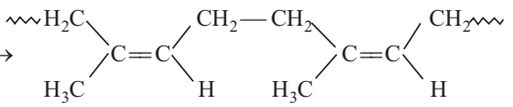
In author's opinion (a) and (b) should also be the answer.

(a) 

(b) 

27. (A) Cellulose—a natural polymer of α-D-glucose, linked by glycoside linkage.
(B) Nylon-6, 6—a synthetic polymer of adipic acid and 1,6-diaminohexane. The diacid is linked with diamine through amide linkage.
(C) Protein—a natural polymer of α-amino acids where individual amino acid units are linked by amide linkage.
(D) Sucrose—has glycoside linkage, a disaccharide.

28. (a) 

(b) Isoprene ⟶ 

natural rubber

29. *Zeigler-Natta* catalyst, which is a mixture of triethylaluminium '$(C_2H_5)_3Al$' and $TiCl_4$, is used as heterogeneous catalyst in polymerisation of ethylene.

30.