Solved Examples

JEE Main/Boards

Example 1: What type of bonding occurs in globular protein?

Sol: Globular protein is spherical in nature and are water soluble. Globular protein may have the following types of bonding: hydrogen bonding, disulphide bridges, ionic or salt bridges, and hydrophobic interactions.

Example 2: What will be the sequence of bases on mRNA molecules synthesized on the following strand of DNA?

TATCTACCTGGA

Sol: The opposite bases bind with the strand i.e. A-T and G-C.

Sequence of bases on mRNA molecule:

DNA strand	TAT CTA CCT GGA
m-RNA	AUA GAU GGA CCU

Example 3: Name one reducing and one nonreducing disaccharide.

Sol: Reducing sugar has a free aldehydic group which can be easily oxidized and can thus reduce other substances.

Maltose or lactose (reducing)

Sucrose (non-reducing)

Example 4: Explain the functions of nucleic acids.

Sol: Nucleic acids are large biomolecules consisting of RNA and DNA.

Nucleic acids have two important functions:

i) Replication: Due to its unique property of self-replication (process by which a single DNA molecule produces two identical species of itself), it is responsible for maintaining the heredity traits from one generation to another.

ii) Protein synthesis: RNA helps in the biosynthesis of proteins and is, in one way, responsible for the process of learning and memory storage. Furthermore, it sends information and instructions to the cell for the manufacture of specific proteins.

Example 5: Define the terms:

(A) Gene (B) Genetic code

(C) Transcription (D) Translation

(E) Codons

Sol: (A) Gene: A gene is a sequence of base triplets in a strand of DNA helix that factions to code a polypeptide chain. The polypeptide chain ultimately becomes the part of the protein synthesized. Every protein in a cell has the corresponding gene.

(B) Genetic code: The relation between the amino acids and the nucleotide triple is called is genetic code.

(C) Transcription: The way the code on DNA is copied to give the complementary code on RNA is called transcription.

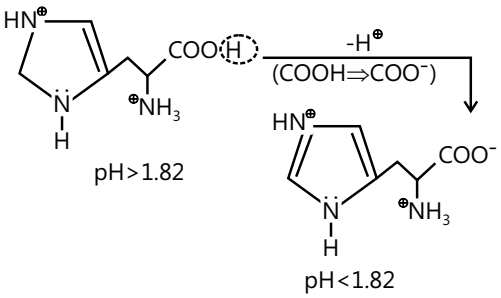
(D) Translation: The way the four-base code in nucleic acid is turned into a 20 unit code needed to specify

The amino acid sequence in proteins during synthesis is called translation.

(E) Codons: The nucleotide bases in RNA function in groups of three (triplets) in coding amino acids. These base triplets are called codons.

Example 6: a. Write the structure of histidine when pH < 1.82 and pH > 1.82.

Sol: a.



Example 7: 'The two strands of DNA are not identical, but are complementary'. Explain this statement.

Sol: DNA consists of two strands of polynucleotides coiled around each other in the form of a double helix. The nucleotides making up each strand of DNA are connected by phosphate ester bonds. This forms the backbone of each DNA strand, from which the bases extend. The bases of one strand of DNA are paired with the bases on the other strand by means of hydrogen bonding. This

hydrogen bonding is very specific as the structure of bases permits only one mode of pairing. Adenine pairs only thymine via two hydrogen bonds and guanine pairs with cytosine through three hydrogen bonds. The two strands of DNA are said to be complementary to each other in the sense that the sequence of bases in one strand automatically determines that of the other. These strands are not identical.

Example 8: Which purine and pyrimidine bases are present in DNA and RNA?

Sol: Adenine and guanine (purine base) in DNA and RNA. Cytosine, thymine, and uracil (pyrimidine base)

Example 9: What are the monomers constituting proteins?

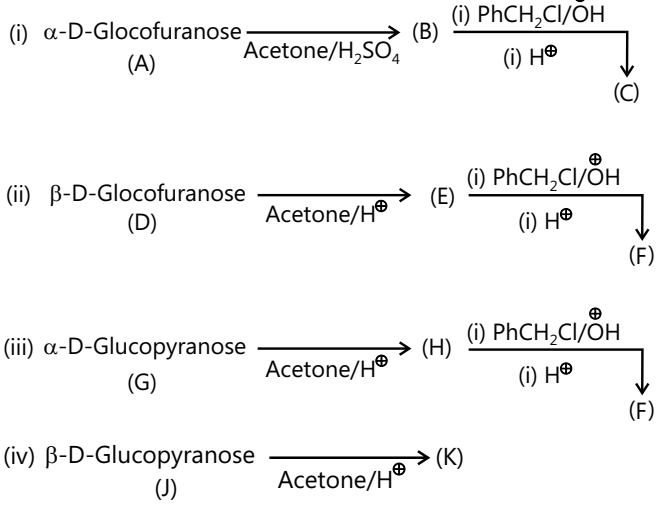
Sol: The amino acids such as glycine and alanine are the monomers that constitute proteins.

Example 10: What is the effect of pH on the action of enzyme?

Sol: The low or high pH values can cause denaturation of the protein and hence make enzyme's protein inactive.

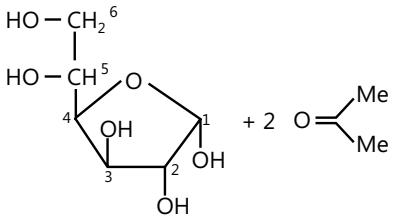
JEE Advanced/Boards

Example 1: Complete the following reactions.

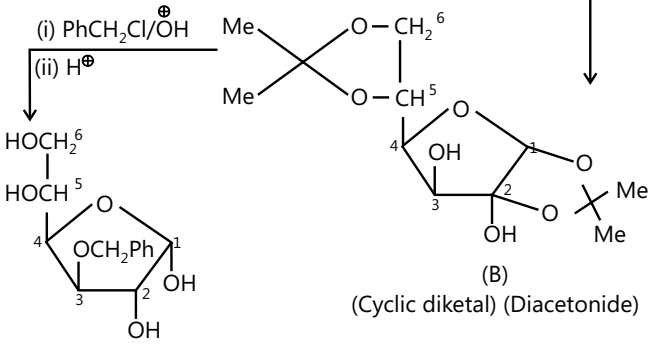


Sol: Acetone forms a cyclic ketal called an acetonide with two cis (OH) groups. D-Glucopyranose is in equilibrium with some D-glucofuranose (having two pais of cis OH groups), the formation of diketal shift the equilibrium toward the reaction D-glucofuranose.

(i)

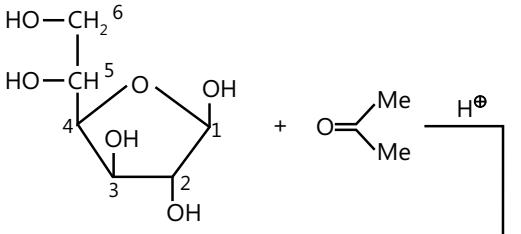


(A)
α-D-Glucopyranose
(Two pair of OH are cis)
(One pair at C-1 and C-2)
(Another pair at C-5 and C-6)

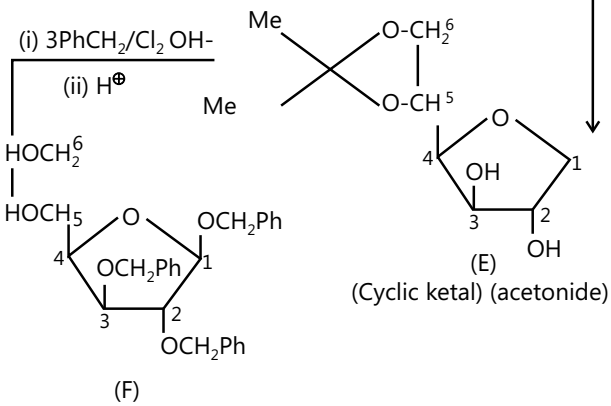


(B)
(Cyclic diketal) (Diacetonide)

(ii)



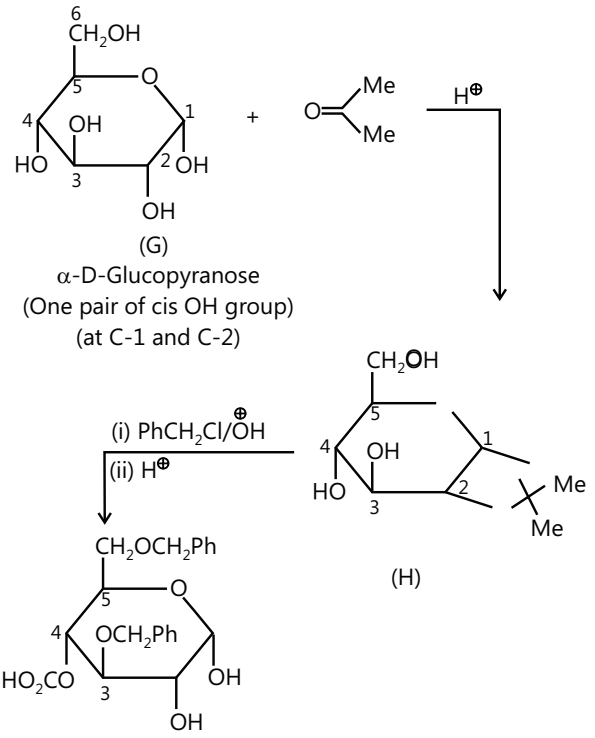
(D)
β-D-Glucofuranose
(One pair of cis OH group)
(at C-5 and C-6)



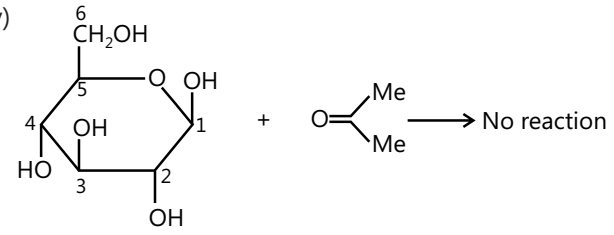
(E)
(Cyclic ketal) (acetonide)

(F)

(iii)



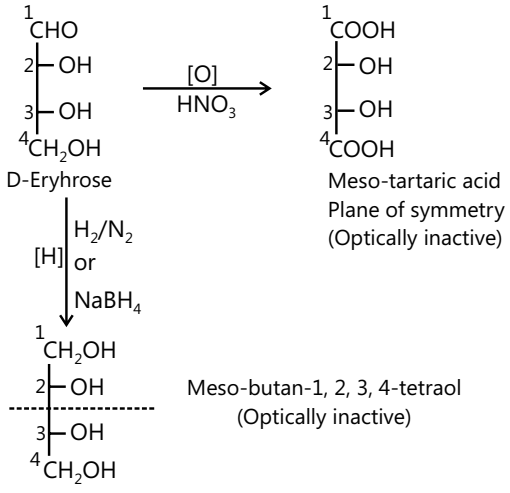
(iv)

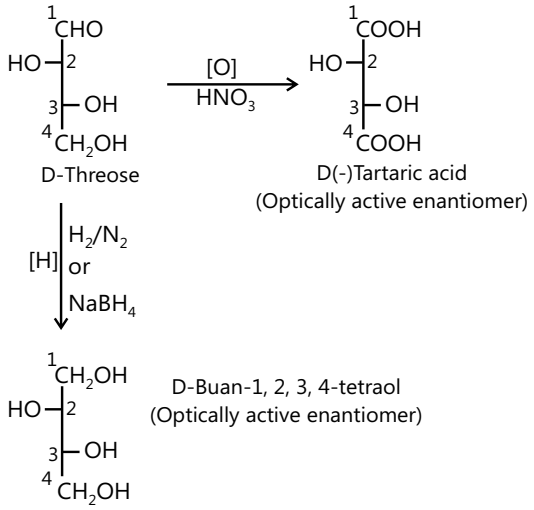


Example 2: Differentiate between D-erythrose and D-threose by

(a) Mild oxidation and (b) Reduction.

Sol:





Example 3: a. Name the smallest aldose that forms cyclic hemiacetal and the functional groups are involved in its formation.

b. What is invert sugar?

c. Calculate the specific rotation of invert sugar.

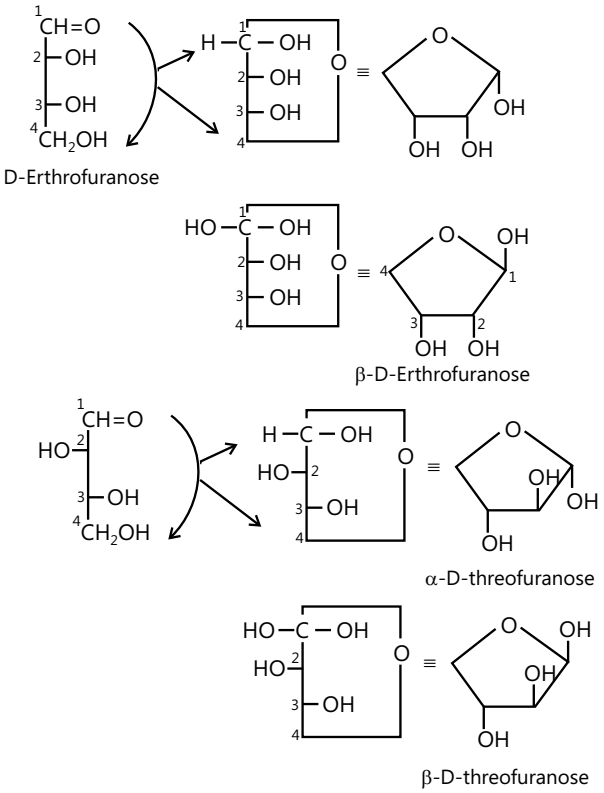
Given, $\alpha|_D$ of D-glucose = 52.7°

$|\alpha|_D$ of D-fructose = –92.4°

d. Give the mechanism of mutarotation of β-D-gluco-pyranose in (i) aq. $H^{\oplus}$ and (ii) $OH^{\ominus}$.

e. Why is the mutarotation faster in the presence of 2-pyridinol?

Sol: a.



b. Equimolar mixture of D-glucose and D-fructose obtained but the hydrolysis of sucrose is called invert sugar. Since the specific rotation of sucrose is positive and after hydrolysis it changes to negative value and this process is called inversion of cane sugar.

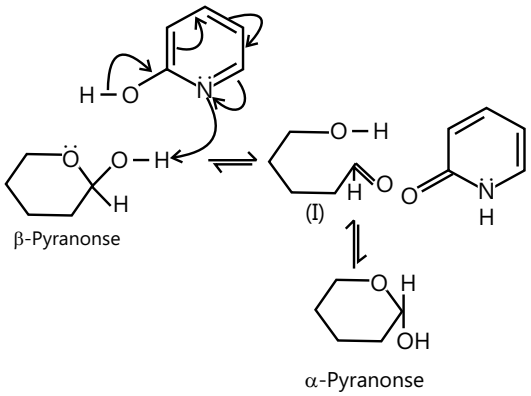
c. The specific rotation is half the sum of specific rotation of glucose and fructose.

Specific rotation of invert sugar = $\frac{1}{2}[+52.7^\circ+(-92.4^\circ)]$ = -19.99°

d. i. In acidic medium:

The smallest aldose is a tetraldose that has four C atoms and an O atom to form a five-membered ring. The CHO group and 1° OH group of tetrose are involved in the formation of ring. Both erythrose and threose form cyclic hemiacetals. The rate depends on the conversion of cyclic hemi- (ii)acetal to open-chain aldehyde (i).

e.2-Pyridinol is an acid-base catalyst [containing both basic $(\ddot{N})$ and acidic (OH) group] that gives H ion to hemiacetalic O atom and simultaneously removes $H^{\oplus}$ ions from the $HO-$ group of the hemiacetal by the formation a cyclic intermediate transition state.



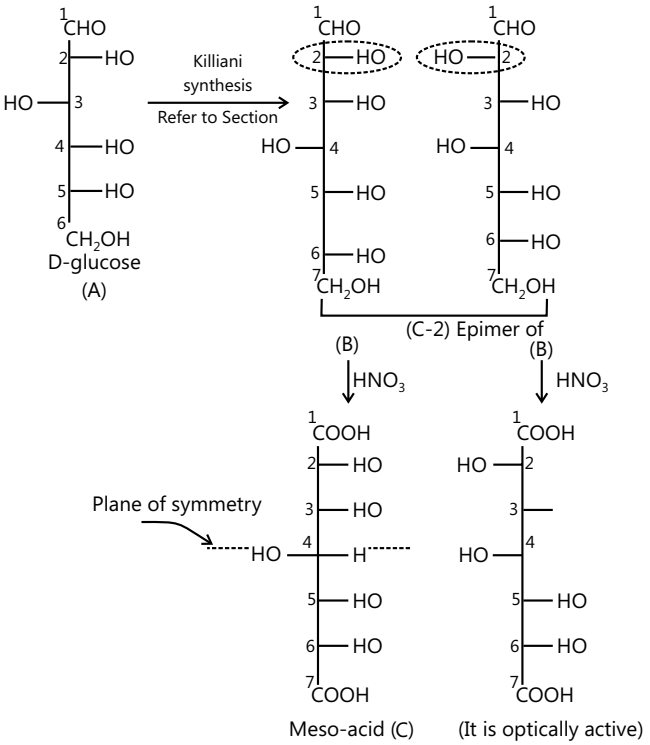
Example 4: Complete the following reactions:

(i) D - Glucose (A) $\xrightarrow[\text{synthesis}]{\text{Killiani}}$ Pair (B) $\xrightarrow{HNO_3}$ Meso-Heptaldaric acid (C)

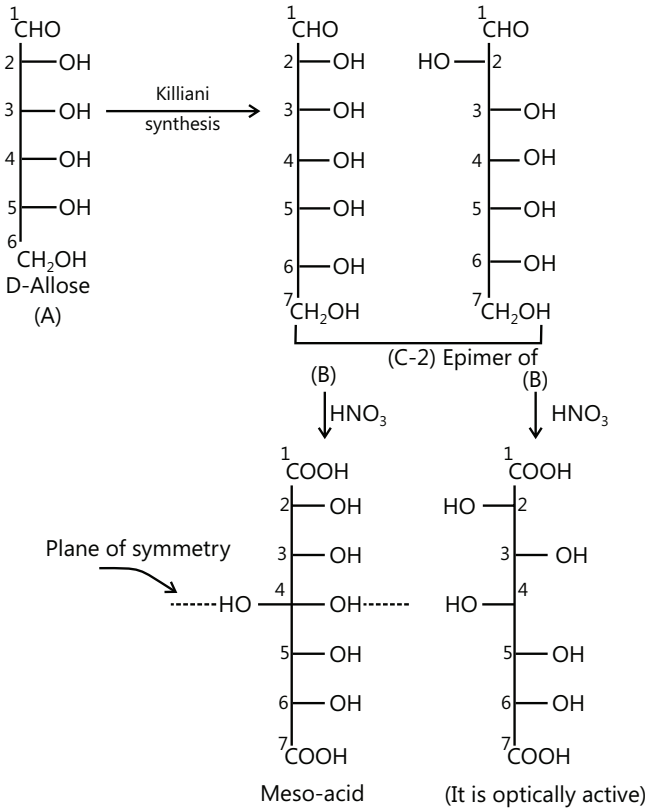
(ii) D - Allose (D) $\xrightarrow[\text{synthesis}]{\text{Killiani}}$ Pair (B) $\xrightarrow{HNO_3}$ Meso-Heptaldaric acid (F)

Explain whether the acids (C) and (F) are same or different. Which pair out of (B) and (E) gives meso-acids (C) and (F)?

Sol: (i)



(ii)



Although both acids (C) and (F) are heptaldric acid and both are meso (optically inactive) but they are different.

Example 5: a. How is the mixture of aspartic acid (A) histidine (B) and threonine (C) separated by electrophoresis method?

pI (pH at isoelectric point) are given.

pI of (A), (B), and (C) are 2.77, 7.59 and 5.60, respectively.

b. How are they separated by solubility method?

Sol: a. Choose the intermediate pH of 5.60. This is the pI of threonin, which has a zero net charge and does not migrate in the electric field or in the electrophoresis experiment.

Aspartic acid (pI = 2.77) [Refer to solved example No. 8 (d) above] donates an $H^{\oplus}$ and is converted to anion (III), and migrates to the anode. Histidine (pI = 7.59) accepts an $H^{\oplus}$ and is converted to a cation, and migrates to the cathode.

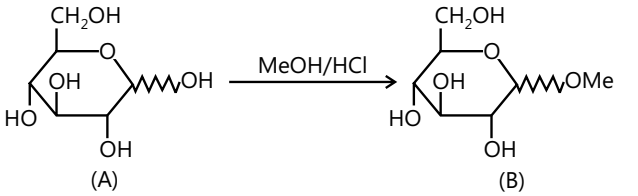
b. At isoelectrical point (pI) the amino acids have least solubility in water and this property is exploited in the separation of different amino acids obtained from the hydrolysis of protein.

To the mixture of three amino acids (A, B and C) set the pH of the solution by adding acid upto 2.77, at which (A) will be least soluble in H_2O and will precipitate out. It is followed by the separation of amino acid (A).

Increase the pH of the remaining solution by adding base upto 5.60, at which amino acid (c) will precipitate out. Similarly, (B) will precipitate out at the pH of 7.59.

Example 6: Convert D-glucopyranose to 2, 3, 4-trimethyl glucopyranoside.

Sol: First convert D-glucose to methyl glucopyranoside with MeOH/HCl. Then CH_2OH is protected by reacting methyl glucopyranoside with Ph_3C—Cl (trityl chloride),

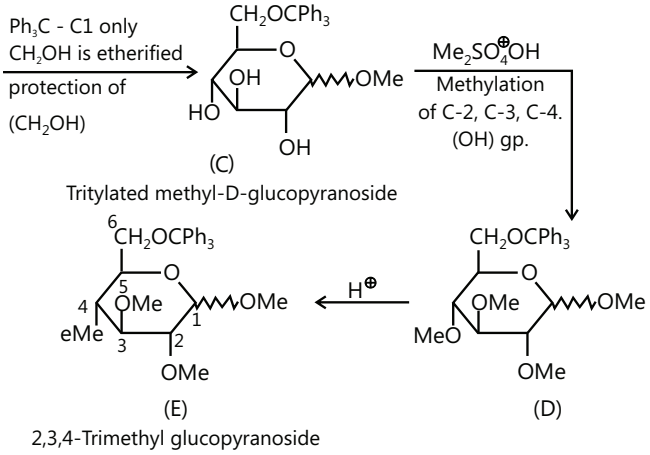


(A) (α-or β-D-glucopyrnose)

(B) Methyl-D-glucopyranoside

Only CH_2OH is etherified giving CH_2OCPh_3 group. The 2° OH groups are sterically hindered and do not react with the bulkyl (Ph_3C—Cl) group.

The free OH groups of tritylated methyl glucosides are now methylated with Me_2SO_4/NaOH followed by acidic hydrolysis removes both trityl group and the glycosidic Me group leaving OMe group at C_2, C_3, and C_4 intact. The hydrolysis of $-OCPh_3$, groups proceeds by the formation of stable $Ph_3C^{\oplus}$ (triphenyl methyl carbocation).



Example 7: Write the names and structures of the monomers of the following polymers:

(i) Buna-S (ii) Buna-N (iii) Dacron (iv) Neoprene.

Sol: The names and structures of the monomers are:

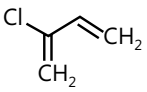
(i) Buna-S:

$$\underset{\text{1,3–Butadiene}}{CH_2 = CH - CH = CH_2} \text{ and } \underset{\text{Styrene}}{C_6H_5 - CH = CH_2}$$

(ii) Buna-N:

$$\underset{\text{1,3–Butadiene}}{CH_2 = CH - CH = CH_2} \text{ and } \underset{\text{Acrylonitrile}}{CH_2 - CH = CN}$$

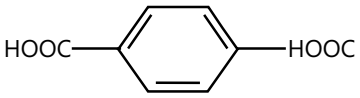
(iii) Neoprene:



Chloroprene or 2 – chloro – 1,3 – butadiene

(iv) Dacron:

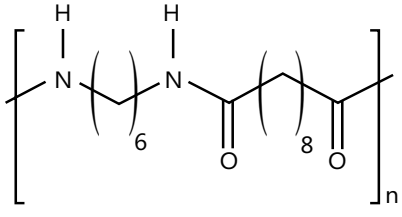
$$\underset{\text{Ethylene glycol}}{HO - CH_2 - CH_2 - OH} \text{ and}$$

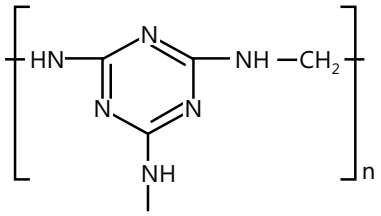


Terephthalic acid

Example 8: Identify the monomer in the following polymeric structures:

(i)

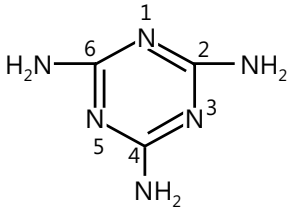


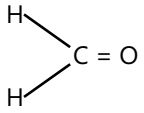
(ii) 

Sol: Monomers are:

(i) $HOOC-(CH_2)_8-COOH$
Decanoic acid or Sebacic acid

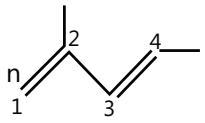
and $H_2N-(CH_2)_6-NH_2$
Hexamthylenediamine

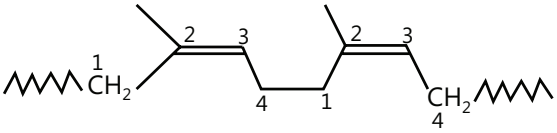
(ii) 
Melamine or
2.4.6.-Triamino-1,3,5-triazine

and 
Formaldehyde

Example 9: How does the presence of double bonds in rubber molecules influence their structure and reactivity?

Sol: Natural rubber is cis-polyisoprene and is obtained by 1, 4-polymerization of isoprene units. In this polymer, double bonds are located between C_2 and C_3 of each isoprene unit. These cis-double bonds do not allow the polymer chains to come closer for effective interactions and hence intermolecular forces are quite weak. As a result, natural rubber, i.e., cis-polyisoprene has a randomly coiled structure and hence shows elasticity.


Isoprene


cis-Polyisoprene
(Natural rubber)

JEE Main/Boards

Exercise 1

Q.1 What happens when D-glucose in treated with the following reagents?

(i) HI (ii) Bromine water (iii) HNO_3

Q.2 Define the following terms in relation to proteins

(i) Peptide linkage (ii) Denaturation

Q.3 Define the following as related to proteins

(i) Peptide linkage (ii) Primary structure

(iii) Denaturation

Q.4 What are the common types of secondary structure of proteins?

Q.5 How do you explain the amphoteric behavior of amino acids?

Q.6 What is the effect of denaturation on the structure of proteins?

Q.7 Describe the following: (i) Glycosidic linkage

Q.8 Enumerate the reactions of D-glucose which cannot be explained by its open chain structure.

Q.9 What are essential and non-essential amino Acids? Give two examples of each type.

Q.10 List any four vitamins. Mention the chief sources and functions of two of them.

Q.11 (i) What are essential and non-essential amino acids? Give two example of each.

(ii) What is a denatured protein?

Q.12 How are vitamins classified? Name the vitamin responsible for the coagulation of blood.

Q.13 Why are vitamins A and vitamin C essential to us? Give their important sources.

Q.14 Draw open chain structure of aldopentose and aldohexose. How many asymmetric carbons are present in each?

Q.15 (a) Describe the following giving one example: Nucleotide.

(b) List four functions of carbohydrates in living organisms.

Q.16 What type of bonding helps in stabilizing the α-helix structure of proteins?

Q.17 Differentiate between globular and fibrous proteins.

Q.18 (a) Give reasons for the following statements:

(i) Amino acids have comparatively higher melting points than the corresponding haloacids.

(b) What deficiency diseases are caused due to lack to lack of vitamins A, B_1, B_6 and K in human diet?

Q.19 The two strands in DNA are not identical but are complementary. Explain.

Q.20 State difference between the following pair

(i) $\boldsymbol{\alpha}$-helix and $\boldsymbol{\beta}$-pleated structures.

(ii) Primary and secondary structures of a protein.

Q.21 What are nucleic acids? Mention their two important functions.

Q.22 What is the difference between a nucleoside and a nucleotide?

Q.23 What are reducing and non-reducing sugar? What is the structural feature characterizing reducing sugars?

Q.24 Distinguish between α-glucose and β-glucose.

Q.25 What happens when L-glucose is treated with the following reagents?

(i) HI (ii) Bromine water (iii) HNO_3

Q.26 Write the important structural and functional differences between DNA and RNA.

Q.27 What are the different types of RNA found in the cell?

Q.28 Define the following and give one example of each

(a) Isoelectric point (b) Mutarotation

(c) Enzymes

Q.29 Answer the following queries about proteins?

(i) How are proteins related to amino acid?

(ii) How are oligopeptides different from polypeptides?

(iii) When is a protein said to be denatured?

Q.30 (a) Name the three major classes of carbohydrates and give the distinctive characteristic of each class.

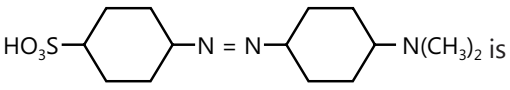
(b) What are nucleotides? Name two classes of nitrogen containing bases found amongst nucleotides.

Exercise 2

Biomolecules

Single Correct Choice Type

Q.1 The chromophore in the dye



is

(A) $-N(CH_3)_2$ (B) $-SO_3H$

(C) $-C_6H_5$ (D) $-N = N-$

Q.2 At the isoelectric point for an amino acid the species present are

(A) $R-\underset{\underset{NH_2}{|}}{CH}-COOH$ (B) $R-\underset{\underset{^+NH_3}{|}}{CH}-COOH$

(C) $R-\underset{\underset{NH_2}{|}}{CH}-COO^-$ (D) $R-\underset{\underset{^+NH_3}{|}}{CH}-COO^-$

Q.3 Secondary structure of a protein refers to

(A) Mainly denatured proteins and structures of prosthetic groups

(B) Regular folding patterns of contiguous portions of the polypeptide chain

(C) Linear sequence of amino acid residues in the polypeptide chain

(D) None of these

Q.4 The general formula of carbohydrates is:

(A) $C_nH_{2n+1}O$ (B) $C_nH_{2n}O$

(C) $C_n(H_2O)_n$ or $C_x(H_2O)_y$ (D) $C_n(H_2O)_{2n}$

Q.5 Which of the following is a disaccharide?

(A) Sucrose (B) Glucose

(C) Fructose (D) Starch

Q.6 The iron in hemoglobin is bound by

(A) Hydrogen bonds (B) Chelation

(C) Ionic bonds (D) Covalent bonds

Q.7 Anomers have different

(A) Properties (B) Melting points

(C) Specific rotation (D) All of these

Q.8 Peptide bond is

(A) – CO – NH – (B) NH_2 – CO – NH – R

(C) R – CO – NH – R (D) – $CONH_2$

Q.9 Glucose and Fructose are

(A) Tautomers (B) Chain isomers

(C) Functional isomers (D) Geometrical isomers

Q.10 Glucose is

(A) Aldopentose (B) Aldohexose

(C) Ketopentose (D) Ketohexose

Q.11 A substance which can act both as an antiseptic and disinfectant is

(A) Aspirin (B) Chloroxylenol

(C) Bithinal (D) Phenol

Q.12 The reagent used in Ruff's degradation is

(A) Baeyer's reagent (B) Tollen's reagent

(C) Fentons' reagent (D) Benedict's reagent

Q.13 If K_{a1} and K_{a2} are the ionization constants of $H_3N^+CHICOOH$ and $H_3N^+CHICOO^-$, respectively, the pH of the solution at the isoelectric point is

(A) $pH = pK_{a1} + pK_{a2}$ (B) $pH = (pK_{a1} + pK_{a2})^{1/2}$

(C) $pH = (pK_{a1} + pK_{a2})^{1/2}$ (D) $pH = \frac{(pK_{a1} + pK_{a2})}{2}$

Q.14 Coordination polymerization was developed by

(A) Zeigler and Natta (B) Linus Pauling

(C) Beckamann (D) None of these

Q.15 Teflon, polystyrene and neoprene are all

(A) Copolymers (B) Condensation polymers

(C) Homopolymers (D) Monomers

Q.16 Carbohydrates which differ in configuration at the glycoside carbon (i.e. C_1 in aldose and C_2 in ketoses) are called

(A) Anomers (B) Epimers

(C) Diastereomers (D) Enantiomers

Q.17 Choose the correct relationship for α-D-glucose (1) and β-D-glucose (2)

(A) A and B are epimers

(B) A and B are crystal modification

(C) A is a pyranose sugar and B is furanose sugar

(D) A is an aldose and B is a ketose.

Q.18 Natural rubber is a polymer of

(A) Chloroprene (B) Isoprene

(C) 1, 3-Butadiene (d) None

Q.19 Hydrolysis of sucrose is called

(A) Saponification (B) Inversion

(C) Esterification (D) Hydration

Q.20 In vulcanization of rubber

(A) Sulphur reacts to form a new compound

(B) Sulphur cross-links are introduced

(C) Sulphur forms a very thin protective layer over rubber

(D) All statements are correct

Q.21 The simplest amino acid is

(A) Glycine (B) Alanine

(C) Guanine (D) All of the above

Q.22 Which of the following belong to the class of natural polymers?

(A) Proteins (B) Cellulose

(C) Rubber (D) All of the above

Q.23 D-Glucose and β-D glucose differ from each other due to difference in one of carbon with respect to its

(A) Size of hemiacetal ring

(B) Number of —OH groups

(C) Configuration

(D) Conformation

Q.24 Glucose gives the silver mirror test with ammoniacal solution of silver nitrate because it contains

(A) Aldehydes group (B) Ester group

(c) Ketone group (D) Amide group

Q.25 Oligosaccharides contain ..... Simple sugar units

(A) 2 to 10 (B) 4 to 8 (C) 6 to 12 (D) 6 to 10

Q.26 A pair of diastereomers that differ only in the configuration about a single carbon atom are called

(A) Anomers (B) Epimers

(C) Conformes (D) Enantiomers

Q.27 Pick out the incorrect statement about ATP.

(A) It is a nucleotide

(B) It contains the purine, adenine

(C) The enzyme-catalysed hydrolysis of ATP to ADP and AMP is accompanied by absorption of energy

(D) Energy is stored in the cell in the form of ATP.

Q.28 Cellulose is a linear polymer of

(A) Glucose (B) Glucose

(C) Fructose (D) None of these

Q.29 Glucose molecule reacts with X number of molecules of phenylhydrazine to yield osazone. The value of X is

(A) Three (B) Two (C) One (D) Four

Q.30 Main structural unit of protein is

(A) Ester linkage (B) Ether linkage

(C) Peptide linkage (D) All the above

Q.31 Which of the following statements is true of proteins?

(A) They catalyse the biochemical reactions

(B) They act as antibodies

(C) They perform all these functions

(D) They perform all these functions

Q.32 Which of the following is a polysaccharide?

(A) Glucose (B) Galactose

(C) Sucrose (D) Pectines

Q.33 Starch can be used as an indicator for the detection of traces of

(A) Glucose in aqueous solution

(B) Proteins in blood

(C) Iodine in aqueous solution

(D) Urea in blood

Q.34 Which of the following statements about ribose in incorrect?

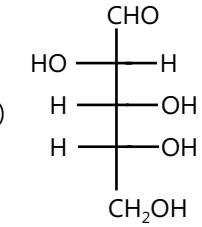
(A) It is polyhydroxy compound

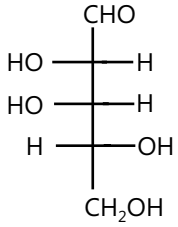
(B) It is an aldehyde sugar

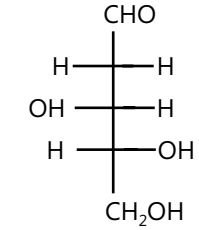
(C) It has six carbon atoms

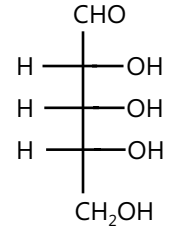
(D) It exhibits optical activity

Q.35 Which of the following is the structure of D-xylose?

(A)


(B)


(C)


(D)


Q.36 Glucose gives the silver mirror test with ammoniacal solution of silver nitrate because it contains the group

(A) Aldehyde (B) Ester

(C) Ketone (D) Amide

Q.37 A condensation polymer among the following is-

(A) Dacron (B) PVC

(C) Polystyrene (D) Teflon

Q.38 Melamine polymer is copolymer of

(A) Melamine and acetaldehyde

(B) Melamine and formaldehyde

(C) Phenol and formaldehyde

(D) None of the above

Q.39 Which one of the following pairs is not correctly matched?

(A) Terylene: Condensation polymer of terephthalic acid and ethylene glycol

(B) Perspex: A homopolymer of methymethacrylate

(C) Teflon: Thermally stable cross-linked polymer of phenol and formaldehyde

(D) Synthetic rubber: A copolymer of butadiene and styrene

Q.40 Orlon is a polymer of-

(A) Styrene (B) Tetrafluoroethylene

(C) Vinyl chloride (D) Acrylonitrile

Q.41 Which one of the following is not an example of chain growth polymer-

(A) Neoprene (B) Buna-S

(C) PMMA (D) Glyptal

Q.42 Ebonite is-

(A) Natural rubber

(B) Synthetic rubber

(C) Highly vulcanized rubber

(D) Polypropene

Q.43 $F_2C = CF_2$ is a monomer of-

(A) Teflon (B) Glyptal (C) Nylon-6 (D) Buna-S

Q.44 P.V.C. is formed by polymerization of-

(A) 1-Chloroethene (B) Ethene

(C) Propene (D) 1-Chloropropene

Q.45 Polyacrylonitrile, characterized by the repeating unit, is made from which of the following monomer?

(A) CH_3CH_2CN (B) $HOCH_2CH_2CH_3$

(C) $CH_3CH = CHCN$ (D) $CH_2 = CHCN$.

Q.46 On the basis of intermolecular forces, polymers are classified as

(A) Elastomers, Fibres, Thermoplastics and Thermosetting

(B) Elastomers, Fibres, Chain growth and Step growth

(C) Addition polymers and Condensation polymers

(D) None of these

Q.47 Which of the following polymers do not involve cross linkages-

(A) Melmac (B) Bakelite

(C) Polythene (D) Vulcanised rubber

Q.48 Ziegler-Natta catalyst is-

(A) $K[KPtCl_3(C_2H_4)]$ (B) $(Ph_3P)_3RhCl$

(C) $Al(C_2H_5)_3+TiCl_4$ (D) $Fe(C_5H_5)_2$

Q.49 Which one of the following monomers give the polymer neoprene on polymerization?

(A) $CH_2 = CHCl$ (B) $CH_2 = CCl – CH = CH_2$

(C) $CF_2 = CF_2$ (D) $CCl_2 = CCl_2$

Q.50 Which of the following pairs is not correctly matched?

(A) Terylene-condensation polymer of terephthalic acid and ethylene glycol

(B) Teflon-thermally stable cross linked polymer of phenol and formaldehyde

(C) Perspex-a homopolymer of methyl methacrylate

(D) Synthetic rubber –a copolymer of butadiene and styrene

Q.51 Which one of the following is used to make 'non-stick' cookware?

(A) PVC

(B) Polystyrene

(C) Polyethylene terephthalate

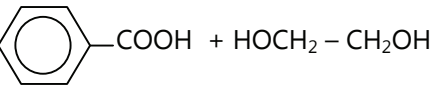
(D) Polytetrafluoroethylene

Q.52 Which compound/set of compounds is used in the manufacture of nylon-66?

(A) $HOOC(CH_2)_4COOH + H_2N(CH_2)_6NH_2$

(B) $CH_2 = CH–CH(CH) = CH_2$

(C) $CH_2 = CH_2$

(D) 

Q.53 Teflon, styron and neoprene are all-

(A) Copolymers (B) Condensation polymers

(C) Homopolymers (D) Monomers

Previous Years' Questions

Q.1 Which of the following pairs give positive Tollen's test? ***(2004)***

(A) Glucose, sucrose (B) Glucose, fructose

(C) Hexanal, acetophenone (D) Fructose, sucrose

Q.2 Two forms of D-glucopyranose, are called ***(2005)***

(A) Enantiomers (B) Anomers

(C) Epimers (D) Diastereomers

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

(a) Statement-I is true; statement-II is true; statement-II is not the correct explanation of statement-I.

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

(c) Statement-I is true; statement-II is false.

(d) Statement-I is false; statement-II is true.

Q.3 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)***

Q.4 $\alpha - D - (+)$ - glucose and $\beta - D - (+)$ - glucose are ***(2008)***

(A) Conformers (B) Epimers

(C) Anomers (D) Enantiomers

Q.5 The two functional groups present in a typical carbohydrate are: ***(2009)***

(A) –OH and –COOH (B) –CHO and –COOH

(C) > C = O and –OH (D) –OH and –CHO

Q.6 Buna-N synthetic rubber is a copolymer of: ***(2009)***

(A) $H_2C = CH - \underset{\displaystyle Cl}{\underset{|}{C}} = CH_2$ and $H_2C = CH - CH = CH_2$

(B) $H_2C = CH - CH = CH_2$ and $H_5C_6 - CH = CH_2$

(C) $H_2C = CH - CN$ and $H_2C = CH - CH = CH_2$

(D) $H_2C = CH - CN$ and $H_2C = CH - \underset{\displaystyle CH_3}{\underset{|}{C}} = CH_2$

Q.7 Biuret test is not given by ***(2010)***

(A) Carbohydrates (B) Polypeptides

(C) Urea (D) Proteins

Q.8 The polymer containing strong intermolecular forces e.g. hydrogen bonding, is ***(2010)***

(A) Teflon (B) Nylon 6, 6

(C) Polystyrene (D) Natural rubber

Q.9 The presence or absence of hydroxyl group on which carbon atom of sugar differentiates RNA and DNA? ***(2011)***

(A) 2^{nd} (B) 3^{rd} (C) 4^{th} (D) 1^{st}

Q.10 Which one of the following statements is correct? ***(2012)***

(A) All amino acids except lysine are optically active

(B) All amino acids are optically active

(C) All amino acids except glycine are optically active

(D) All amino acids except glutamic acid are optically active

Q.11 Synthesis of each molecule of glucose in photosynthesis involves: ***(2013)***

(A) 18 molecules of ATP (B) 10 molecules of ATP

(C) 8 molecules of ATP (D) 6 molecules of ATP

Q.12 Which one is classified as a condensation polymer? ***(2014)***

(A) Dacron (B) Neoprene

(C) Teflon (D) Acrylonitrile

Q.13 Which one of the following bases is **not** present in DNA? ***(2014)***

(A) Quinoline (B) Adenine

(C) Cytosine (D) Thymine

Q.14 Which polymer is used in the manufacture of paints and lacquers? ***(2015)***

(A) Bakelite (B) Glyptal

(C) Polypropene (D) Poly vinyl chloride

Q.15 Which of the vitamins given below is water soluble? ***(2015)***

(A) Vitamin C (B) Vitamin D

(C) Vitamin E (D) Vitamin K

Q.16 Which of the following statements about low density polythene is FALSE? ***(2016)***

(A) It is a poor conductor of electricity.

(B) Its synthesis required dioxygen or aperoxide initiator as a catalyst.

(C) It is used in the manufacture of buckets, dust-bins etc.

(D) Its synthesis requires high pressure.

Q.17 Which of the following is an anionic detergent? ***(2016)***

(A) Sodium lauryl sulphate

(B) Cetyltrimethyl ammonium bromide

(C) Glyceryl oleate

(D) Sodium stearate

Q.18 Thiol group is present in: ***(2016)***

(A) Cystine (B) Cysteine

(C) Methionine (D) Cytosine

JEE Advanced/Boards

Exercise 1

Q.1 State a use for the enzyme streptokinase in medicine.

Q.2 Why is cellulose in our diet not nourishing?

Q.3 Explain muta-rotation taking D-glucose as an example.

Q.4 Enumerate the structural difference between DNA and RNA. Write down the structure of sugar present in DNA.

Q.5 Answer the following queries about proteins-

(i) How are proteins related to amino acids?

(ii) How are oligopeptides different from polypeptides?

(iii) When is a protein said to be denatured?

Q.6 (a) Define and classify vitamins. Give at least two example of each type.

(b) Define an enzyme and comment on the specificity in action of an enzyme. Illustrate with an example.

Q.7 What are essential and non-essential amino acids? Give two examples of each.

Q.8 (a) Define the following term:

(i) Co-enzymes

Q.9 (a) Answer the following questions briefly

(i) What are any two good sources of vitamin A?

(ii) What are nucleotides?

(b) How are carbohydrates classified?

Q.10 Write two main functions of carbohydrates in plants.

Q.11 What happens when D-glucose is treated with the following reagents?

(i) alk.$KMnO_4$ (ii) $Br_2 + CS_2$ (iii) H_2SO_4

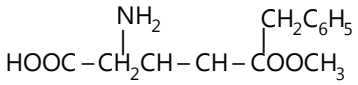
Q.12 Name the four bases present in DNA. Which one of these is not present in RNA?

Q.13 Name two fat soluble vitamins that sources and diseases caused due to their deficiency in diet.

Q.14 State a use for the enzyme streptokinase in medicine.

Q.15 Write the major classes in which the carbohydrates are divided?

Q.16 Aspartame, an artificial sweetener, is a peptide and has the following structures:



(a) Identify the four functional groups.

(b) Write the zwitter ionic structure

(c) Write the structure of the amino acids obtained from the hydrolysis of aspartame.

(d) Which of the two amino acids is more hydrophobic?

Q.17 Give the chemical name of vitamin B_{12}.

Q.18 What are the following substances?

(i) Invert sugar (ii) Polypeptides

Q.19 Which forces are responsible for the stability of α-helix? Why is it named as 3.6_{13} helix?

Q.20 What are complementary bases? Draw structure to show hydrogen bonding between adenine and thymine and between guanine and cytosine.

Q.21 Give reasons for the following:

(i) On electrolysis in acidic solution amino acids migrate towards cathode, while in alkaline solution these migrate towards anode.

(ii) The monoamino monocarboxylic acids have two pK values.

Q.22 Glycine exists as a Zwitter ion but anthranilic acid does not comment.

Q.23 Write the difference between DNA and RNA?

Q.24 Explain structure of protein.

Exercise 2

Single Correct Choice Type

Q.1 If the sequence of bases in one strand of DNA is ATGACTGTC, then the sequence of bases in its complementary strand is

(A) TACTGACAG (B) TUCTGUCUG

(C) GUACTUAUG (D) None of these

Q.2 During hydrogenation of oils, higher melting 'vegetable ghee' is formed because

(A) Hydrogen is dissolved in the oil

(B) Hydrogen combines with oxygen of the oil

(C) Ester of unsaturated fatty acids are reduced to those of saturated acids

(D) Hydrogen drives off the impurities from the oil

Q.3 Structurally a biodegradable detergent should contain a

(A) Normal alkyl chain (B) Branched alkyl chain

(C) Phenyl side chain (D) Cyclohexyl side chain

Q.4 Thrust imparted to the rocket is governed by the

(A) Third law of thermodynamics

(B) Gravitational law

(C) Newton's third law

(D) None of these

Q.5 Which of the following represent a bi-liquid propellant?

(A) N_2O_4 + unsymmetrical dimethylhydrazine

(B) N_2O_4 + acrylic rubber

(C) Nitroglycerine + nitrocellulose

(D) Polybutadiene + ammonium perchlorate

Q.6 'Placedo' is often given to patients. It is

(A) An antidepressant

(B) A broad spectrum antibiotic

(C) A sugar pill

(D) A tonic

Q.7 An aldohexose (e.g., glucose) and 2-oxohexose (e.g., fructose) can be distinguished with the help of

(A) Tollen's reagent (B) Fehling's solution

(C) Benedict solution (D) Br_2 / H_2O

Q.8 The open-chain glucose on oxidation with HIO_4 gives

(A) 5 HCOOH + H_2C = O

(B) 4 HCOOH + 2 H_2C = O

(C) 3 HCOOH + 3 H_2C = O

(D) 2 HCOOH + 4 H_2C = O

Q.9 Glucose and fructose give the same osazone. One may, therefore, conclude that

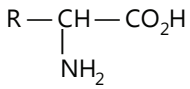
(A) Glucose and fructose have identical structures

(B) Glucose and fructose are anomers

(C) The structure of glucose and fructose have mirror-image relationship

(D) The structure of glucose and fructose differ only in those carbon atoms which take part in osazone formation.

Q.10 For α-amino acid having the structure



Which of the following statements are true?

(a) Water solubility is maximum at a pH when concentration of anions and cations are equal.

(b) They give ninhydrin test

(c) On reacting with nitrous acid give of N_2

(A) All (B) b and c

(C) a and b (D) None of these

Q.11 Bakelite is obtained from phenol and formaldehyde. The initial reaction between the two compounds is an example of

(A) Aromatic electrophilic substitution

(B) Aromatic nucleophilic Substitution

(C) Free radical reaction

(D) Aldol reaction

Q.12 If N_1, N_2, N_3,..... are number of molecules with molecular masses M_1, M_2, M_3, ... respectively, then average molecular mass is expressed as

(A) $\frac{\Sigma N_i M_i^2}{N_i M_i}$ (B) $\frac{\Sigma N_i M_i}{\Sigma N_i}$

(C) Both (A) and (B) (D) None of these

Q.13 The ratio of weight average molecular mass to number average molecular mass is called as

(A) Planck's disposal index

(B) Polydiagonal index

(C) Polydispersity index

(D) None of these

Q.14 The best way to prepare polyisobutylene is

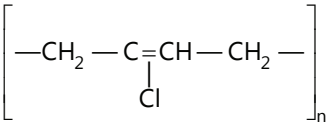
(A) Coordination polymerization

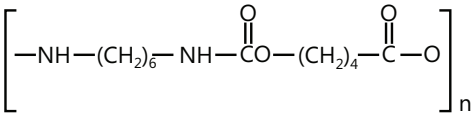
(B) Free radial polymerization

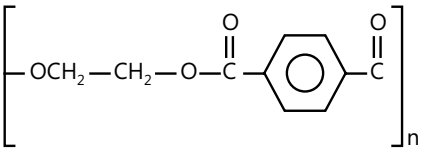
(C) Cationic polymerization

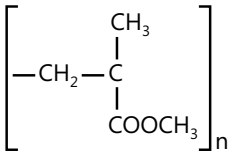
(D) Anionic polymerization

Q.15 Which of the following is not correctly matched?

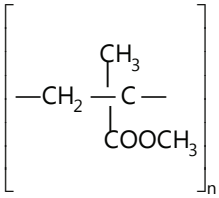
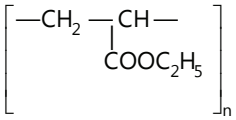
(A) Neoprene; 

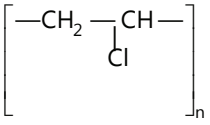
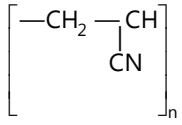
(B) Nylon-6; 

(C) Terylene; 

(D) PMMA; 

Q.16 Acrilan is a hard, horny and a high melting material. Which of the following represent its structure?

(A)  (B) 

(C)  (D) 

Q.17 Which of the following statement/s is (are) correct?

(A) Vinyon is a copolymer of vinyl chloride and vinyl acetate

(B) Saran is copolymer of vinyl chloride and vinylidene chloride

(C) Butyl rubber is a copolymer of isobutylene and isoprene

(D) All are correct

Q.18 Plexiglass (perspex) is

(A) Polyacrylonitrile (B) Polyethylacrylate

(C) Polystyrene (D) Polymethylmethacrylate

Multiple Correct Choice Type

Q.19 Which of the following statement (s) is (are) true?

(A) All amino acids contain one chiral centre

(B) Some amino acids contain one, while some contain more chiral center or even no chiral center

(C) All amino acids found in proteins have L configuration

(D) All amino acids found in proteins have 1° amino group

Q.20 Pick out correct statements.

(A) In an electrolysis experiment, amino acids migrate at the isoelectric point towards electrodes

(B) p-aminobenzensulphonic acid is a dipolar ion: while p-aminobenzoic acid is not

(C) Sulphanilic acid is soluble in base, but not in acid

(D) $H_3\overset{\oplus}{N}CH_2COOH$(pka = 2.4) is more acidic than RCH_2COOH (pKa = 4–5)

Q.21 Which of the following statements is/ are correct?

(A) Polyethylene contains double bonds

(B) The monomer used to make Teflon is C_2F_4

(C) Condensation polymers are known as copolymers

(D) A denatured protein could have the same primary structure as the active protein.

Assertion Reasoning Type

Questions 22-29

Each of the questions given below consists of two statements, an assertion (A) and reason (R). Select the number corresponding to the appropriate alternative as follows

(A) If both assertion and reason are true and reason is the correct explanation of assertion.

(B) If both assertion and reason are true but reason is not the correct explanation of assertion.

(C) If assertion is true but reason is false.

(D) If both assertion and reason are false.

Q.22 Assertion: The enzyme amylase hydrolyses starch to maltose.

Reason: Starch is polymer containing glycosidic linkages.

Q.23 Assertion: A solution of sucrose in water is dextrorotatory but on hydrolysis in the presence of small amount of dil. HCl, it becomes laevorotatory.

Reason: Sucrose on hydrolysis gives unequal amounts of glucose and fructose as a result of which change in sign of rotation is observed.

Q.24 Assertion: Each turn of the α-helix structure of protein forms α 13 membered ring the containing 3.6 amino acids.

Reason: α-helix is a secondary of protein which gets stabilized via hydrogen bonding and disulphide linkages.

Q.25 Assertion: Styrene is more reactive than propylene towards cationic polymerization.

Reason: The carbocation resulting from styrene is more stable than that resulting from propylene.

Q.26 Assertion: Natural rubber is all cis-polyisoprene.

Reason: trans-Polyisoprene cannot be formed.

Q.27 Assertion: PMMA is used for making lenses and light covers.

Reason: It has excellent light transmission properties.

Q.28 Assertion: Polyvinyl alcohol is obtained by polymerization of vinyl alcohol

Reason: Polyvinyl alcohol is prepared by hydrolysis of polyvinyl acetate.

Q.29 Assertion: Nylon-6 is obtained by polymerization of caprolactum

Reason: It is a polyamide.

Comprehension Type

Paragraph 1: The utility of the polymers in various fields is due to their mechanical properties like tensile strength, elasticity, toughness etc.

These properties mainly depend upon intermolecular forces like van der Waal's forces and hydrogen bonding operating in polymer molecules. Polymers have been classified on this basis, e.g.,

(A) Elastomers (B) Fibers

(C) Thermoplastics (D) Thermosetting

Q.30 The molecular forces of attraction are weakest in

(A) Elastomers (B) Fibers

(C) Thermoplastics (D) Thermosetting polymers

Q.31 Which of the following have usually a linear structure?

(A) Thermoplastics (B) Thermosetting polymers

(C) Polyethylene (D) Nylon-66

Q.32 Which of the following is hard?

(A) Elastomer (B) Fibre

(C) Thermoplastic (D) Thermosetting polymers

Paragraph 2: A natural elastomer polymer when with sulphur got stiff and resistant to action of common solvents and wear & tear.

Q.33 The natural polymer is:

(A) Rubber (B) Cellulose (C) Silk (D) Starch

Q.34 Heating of polymer with sulphur is called:

(A) Galvanisation (B) Saponification

(C) Vulcanization (D) None of these

Match the Columns

Q.35 Match list I with list II and select the correct answer using the codes given below the lists.

	List I		List II
I.	Nucleic acids	(p)	D.N.A.
II.	Uracil	(q)	Hormones
III.	Thymine	(r)	Polynucleotides
IV.	Double-helix structure	(s)	R.N.A.

(A) I → s, II → r, III → p, IV → p

(B) I → r, II → s, III → p, IV → p

(C) I → r, II → p, III → s, IV → p

(D) None of these

Q.36

	List I		List II
I.	Pepsin	(p)	Genetic material
II.	Nucleic acid	(q)	Sex hormone
III.	Ascorbic acid	(r)	Vitamin C
IV.	Testosterone	(s)	Digestive enzyme

(A) I → s, II → p, III → r, IV → q

(B) I → s, II → p, III → q, IV → r

(C) I → s, II → p, III → r, IV → q

(D) None of these

Q.37 Match list I with list II and select the correct answer using the codes given below the lists.

	List I		List II
	(Polymer)		(Polymerizing units)
I.	Bakelite	(p)	Butadiene and styrene
II.	Dacron	(q)	Phenol and methanal
III.	Nylon-66	(r)	1, 2-dihydroxyethane and dimethylterephthalate
IV.	Buna-S	(s)	Urea and methanol
		(t)	1, 6-hexanedioic acid and 1, 6-dimino hexane

(A) I → s, II → r, III → t, IV → p

(B) I → q, II → r, III → t, IV → p

(C) I → t, II → q, III → r, IV → p

(D) None of these

Q.38 Match list I with list II and select the correct answer using the codes given below the lists.

	List I		List II
I.	Phenol + formaldehyde.	(p)	Synthec rubber
II.	Terephthalic acid	(q)	Bakelite + ethylene glycol
III.	Caprolactam	(r)	Nylon-6
IV.	Butadiene+styrene	(s)	terylene

(A) I → q, II → r, III → s, IV → p

(B) I → r, II → p, III → q, IV → s

(C) I → q, II → s, III → r, IV → p

(D) None of these

Q.39 Match list-I (Monomer) with list-II (Polymer) and select the correct answer using the codes given below the lists:

	List I		List II
I.	Hexamethylenediamine	(p)	Bakelite
II.	Phenol	(q)	Dacron
III.	Phthalic acid	(r)	Glyptal
IV.	Terephtalic acid	(s)	Melamine
		(t)	Nylon 6, 6

(A) I → t, II → p, III → q, IV → r

(B) I → t, II → p, III → r, IV → q

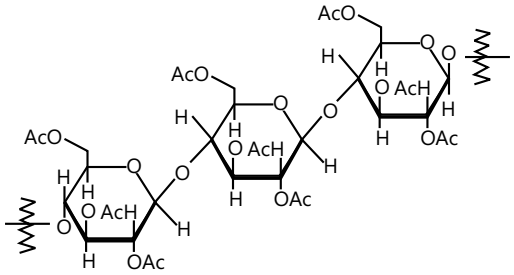
(C) I → s, II → r, III → p, IV → q

(D) I → s, II → r, III → p, IV → q

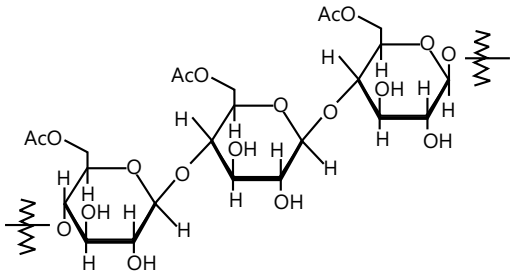
Previous Years' Questions

Q.1 Cellulose upon acetylation with excess acetic anhydride/H_2SO_4 (catalytic) gives cellulose triacetate whose structure is ***(2008)***

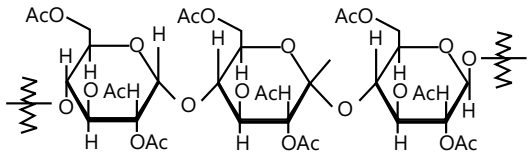
(A)



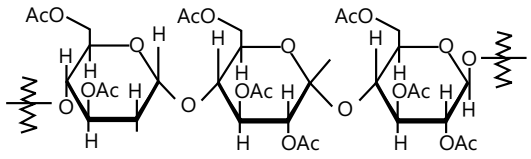
(B)



(C)



(D)

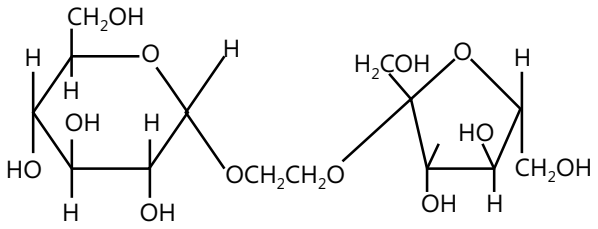


Q.2 Among cellulose, poly (vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is ***(2012)***

(A) Nylon (B) Poly (vinyl chloride)

(C) Cellulose (D) Natural rubber

Q.3 The correct statement about the following disaccharide is ***(2012)***



(a) (b)

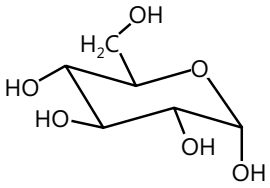
(A) Ring (a) is pyranose with α-glycosidic link

(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

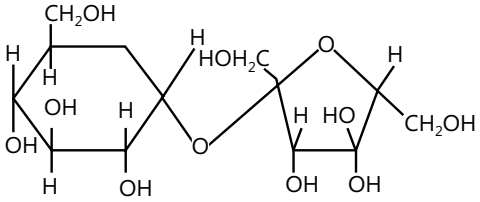
Q.4 The following carbohydrate is ***(2011)***



(A) A ketohexose (B) An aldohexose

(C) An α-furanose (D) An α-pyranose

Q.5 The correct statement (s) about the following sugars X and Y is (are): ***(2011)***



X

(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 linkage in X and Y are α and β respectively

(D) The glucosidic linkage in X and Y are β and α, respectively

Q.6 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)***

(A) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose

(B) 'invert sugar' is an equimolar mixture of D-(+)-glucose and D-(-)-fructose

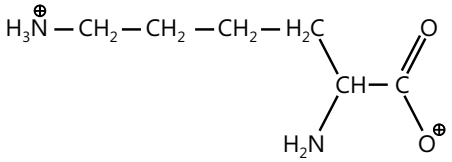
(C) Specific rotation of 'invert sugar' is –20°

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

Q.7 Match the chemical substances in column I with type of polymers/type of bonds in column II. Indicate your answer by darkening the appropriate bubbles of the 4 × 4 matrix given in the ORS. ***(2007)***

Column I	Column II
(A) Cellulose	(p) Natural polymer
(B) Nylon-6, 6	(q) Synthetic polymer
(C) Protein	(r) Amide linkage
(D) Sucrose	(s) Glycoside linkage

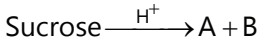
Q.8 The total number of basic group in the following form of lysine is ***(2010)***



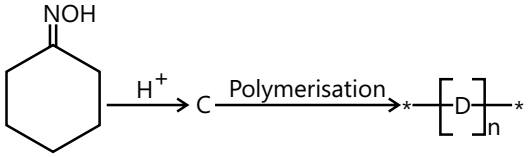
Q.9 A decapeptide (Mol. Wt. 796) on complete hydrolysis gives glycine (Mol. Wt. 75), alanine and phenylalanine. Glycine contributes 47.0 % to the total weight of the hydrolysed products. The number of glycine units present in the decapeptide is ***(2011)***

Q.10 Write the structure of alanine at pH = 2 and pH = 10. ***(2000)***

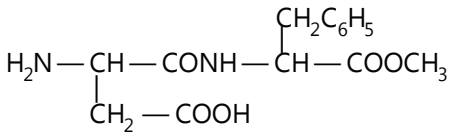
Q.11 Give the structure of the products in the following reaction ***(2000)***



Q.12 Give the structure of the products in the following reaction ***(2000)***



Q.13 Aspartame, an artificial sweetener, is a peptide and has the following structure ***(2001)***



(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 in more hydrophobic?

Q.14 Name the heterogenous catalyst used in the polymerization of ethylene. ***(2003)***

Q.15 Statement-I: Glucose gives a reddish-brown precipitate with Fehling's solution. ***(2007)***

Statement-II: Reaction of glucose with Fehling's solution gives CuO and gluconic acid.

(A) Statement-I is True, statement-II is True; statement-II is a correct explanation for statement-I

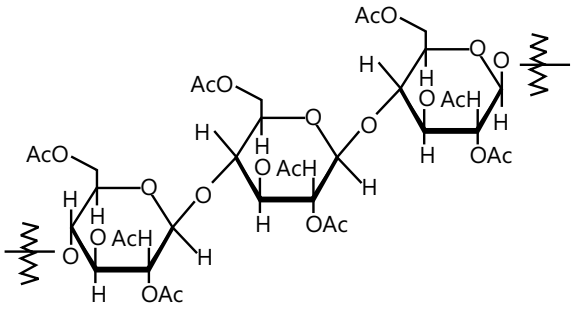
(B) Statement-I is True, statement-II is True; statement-II is NOT a correct explanation for statement-I

(C) Statement-I is True, statement-II is False

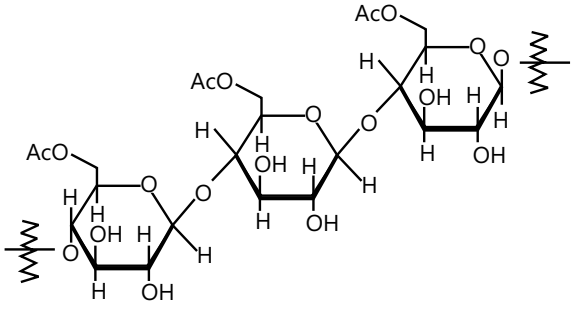
(D) Statement-I is False, statement-II is True

Q.16 Cellulose upon acetylation with excess acetic anhydride / H_2SO_4 (catalytic) gives cellulose triacetate whose structure is ***(2008)***

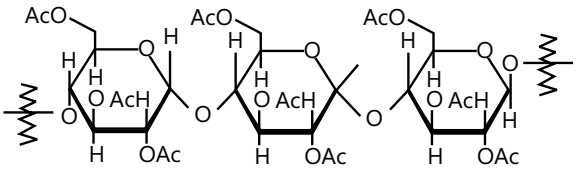
(A)



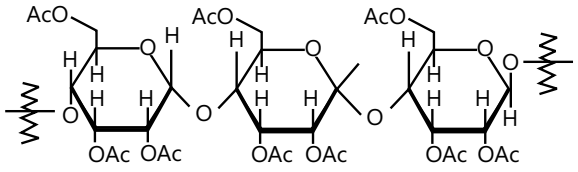
(B)



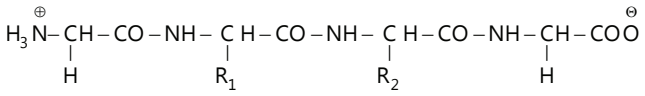
(C)



(D)



Q.17 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

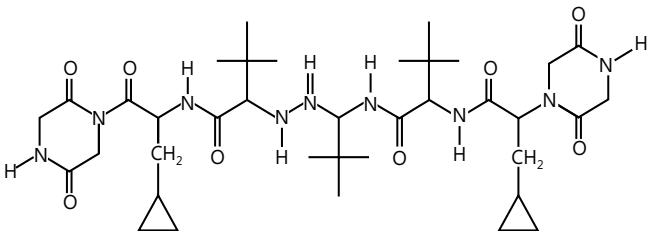
Q.18 When the following aldohexose exists in its D-configuration, the total number of stereoisomers in its pyranose form is ***(2012)***

$CHO - CH_2 - CHOH - CHOH - CH_2OH$

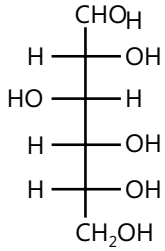
Q.19 A tetrapeptide has –COOH group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (primary structures) with $-NH_2$ group attached to a chiral center is ***(2013)***

Q.20 The total number of lone-pairs of electrons in melamine is ***(2013)***

Q.21 The total number of distinct naturally occurring amino acids obtained by complete acidic hydrolysis of the peptide shown below is ***(2014)***

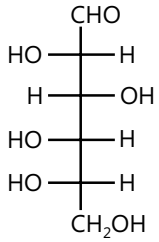


Q.22 The structure of D-(+)-glucose is ***(2015)***

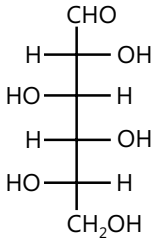


The structure of L-(–)-glucose is

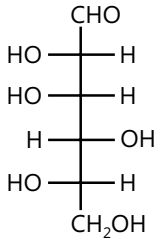
(A)



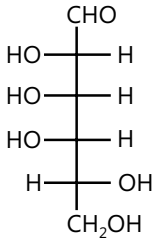
(B)



(C)



(D)



Q.23 Under hydrolytic conditions, the compounds used for preparation of linear polymer and for chain termination, respectively, are ***(2015)***

(A) CH_3SiCl_3 and $Si(CH_3)_4$

(B) $(CH_3)_2SiCl_2$ and $(CH_3)_3SiCl$

(C) $(CH_3)_2SiCl_2$ and CH_3SiCl_3

(D) $SiCl_4$ and $(CH_3)_3SiCl$

Q.24 On complete hydrogenation, natural rubber produces ***(2016)***

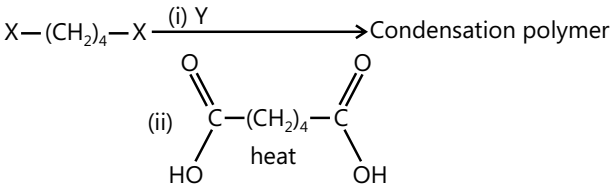
(A) Ethylene-propylene copolymer

(B) Vulcanised rubber

(C) Polypropylene

(D) Polybutylene

Q.25 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

MASTERJEE Essential Questions

JEE Main/Boards

Exercise 1

Q.5 Q.14 Q.18 (i)
Q.23 Q.24

Exercise 2

Q.1 Q.11 Q.20
Q.27 Q.33 Q.39
Q.43 Q.38 Q.40
Q.48 Q.51

Previous Years' Questions

Q.3

JEE Advanced/Boards

Exercise 1

Q.1 Q.11 (a) Q.14
Q.22 Q.25

Exercise 2

Q.2 Q.8 Q.19
Q.13 Q.15 Q.27

Previous Years' Questions

Q.1 Q.5 Q.12
Q.13

Answer Key

JEE Main/Boards

Exercise 2

Single Correct Choice Type

Q.1 D **Q.2** D **Q.3** C **Q.4** C **Q.5** A **Q.6** B
Q.7 C **Q.8** A **Q.9** C **Q.10** B **Q.11** D **Q.12** C
Q.13 D **Q.14** A **Q.15** C **Q.16** A **Q.17** A **Q.18** B
Q.19B **Q.20** B **Q.21** A **Q.22** D **Q.23** C **Q.24** A

Q.25 A **Q.26** B **Q.27** C **Q.28** B **Q.29** A **Q.30** C

Q.31 D **Q.32** D **Q.33** C **Q.34** C **Q.35** C **Q.36** A

Q.37 A **Q.38** B **Q.39** C **Q.40** D **Q.41** D **Q.42** C

Q.43 A **Q.44** A **Q.45** D **Q.46** A **Q.47** C **Q.48** C

Q.49 B **Q.50** B **Q.51** D **Q.52** A **Q.53** C

Previous Years' Questions

Q.1 B **Q.2** B **Q.3** C **Q.4** C **Q.5** C **Q.6** C

Q.7 A **Q.8** B **Q.9** A **Q.10** C **Q.11** A **Q.12** A

Q.13 A **Q.14** B **Q.15** A **Q.16** C **Q.17** A **Q.18** B

JEE Advanced/Boards

Exercise 2

Single Correct Choice Type

Q.1 A **Q.2** C **Q.3** D **Q.4** C **Q.5** A **Q.6** C

Q.7 D **Q.8** A **Q.9** D **Q.10** B **Q.11** A **Q.12** A

Q.13 C **Q.14** C **Q.15** B **Q.16** D **Q.17** D **Q.18** D

Multiple Correct Choice Type

Q.19 B, C **Q.20** B, C, D **Q.21** B, C, D

Assertion Reasoning Type

Q.22 A **Q.23** C **Q.24** C **Q.25** C **Q.26** C **Q.27** A

Q.28 D **Q.29** B

Comprehension Type

Paragraph 1: **Q.30** A **Q.31** A **Q.32** D

Paragraph 2: **Q.33** A **Q.34** C

Match the Columns

Q.35 B **Q.36** C **Q.37** B **Q.38** C **Q.39** B

Previous Years' Questions

Q.1 A **Q.2** B **Q.3** A **Q.4** B **Q.5** B, C **Q.6** B,C

Q.7 A $\rightarrow$ p, s; B $\rightarrow$ q, r; C $\rightarrow$ p, r; D $\rightarrow$ s **Q.8** 2 **Q.9** 6 **Q.15** C **Q.16** A

Q.17 D **Q.18** 8 **Q.19** 4 **Q.20** 6 **Q.21** 1 **Q.22** A

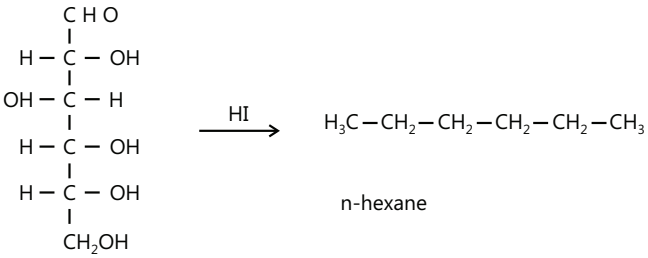
Q.23 B **Q.24** A **Q.25** C, D

Solutions

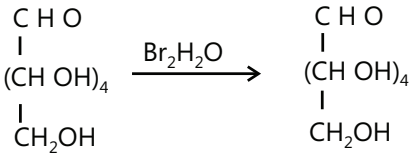
JEE Main/Boards

Exercise 1

Sol 1: (i)

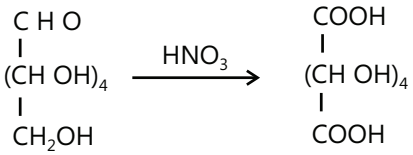


(ii)



D-Gluconic Acid

(iii)



Glucaric acid

Sol 2: (i) Peptide Linkage: The linkage $(-CO-NH-)$ is known as peptide linkage. This linkage is found in the primary structure of proteins.

(ii) Denaturation – when the proteins are sulgected to the action of heat, mineral acids or alkali, the water soluble form of globular protein changes to water insoluble fibrous protein resulting in the precipitation or coagulation of protein, called denaturation of proteins.

Sol 3: (i) Peptide Linkage: The linkage $(-CO-NH-)$ is known as peptide linkage. This linkage is found in the primary structure of proteins.

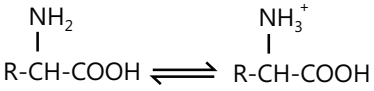
(ii) The primary structure of proteins refer to its covalent structure, i.e sequence in which various $\alpha-$amino acids are arranged in protein or in the polypeptide structure of protein.

(iii) Denaturation – when the proteins are subjected to the action of heat, mineral acids or alkali, the water soluble form of globular protein changes to water insoluble fibrous protein resulting in the precipitation or coagulation of protein, called denaturation of proteins.

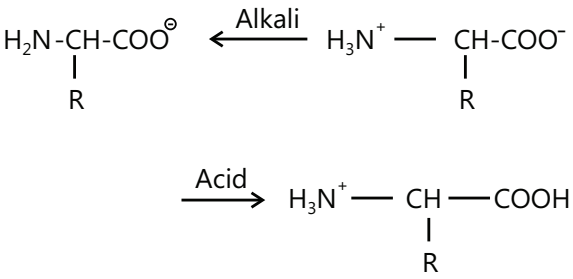
Sol 4: (i) α – Helix structure: This structure is acquired when the alkyl groups in amino acids are large and are involved in the coiling of the polypeptide chain. This is stabilized by the intermolecular hydrogen bond between the $\diagdown\!\!\diagup C=O$ group of one amino acid and $-NH$ group of the fourth amino acid.

(ii) β – pleatedstructure: This structure is acquired when the alkyl group are small in this structure. Linear polypeptide chains are arranged side by side and stabilised by intermolecular hydrogen bond between $\diagdown\!\!\diagup C=O$ and $-NH$ group.

Sol 5: The amino acids containing one carboxylic group and one amino group behave like a neutral molecule. This is due to the formation of a zurtter ion structure.



This zwitter ion changes to cation in acidic solution and anion in alkaline medium. making it amphoteric in nature.



Sol 6: Due to denaturation, water soluble form of globular protein changes to water insoluble fibrous protein, resulting in the precipitation or coagulation of protein.

Sol 7: (i) A glycosidic linkage is a type of covalent bond that joins a carbohydrate molecule to another group which may or may not be another carbohydrate.

Sol 8: (i)Glucose does not undergo certain reactions of aldehydes, for ex reaction with $NaHSO_3$ schiff's test etc.

(ii) Reaction of glucose with NH_2OH

(iii) Mutarotation of α and β glucose

(iv) Formation of two isomeric methyl glycosides when treated with methanol.

Sol 9: Essential amino acids: Amino acids which cannot by synthesized by the body and therefore needs to taken through external diet. For ex. Phenylalanine, valine

Non-Essential amino acids: - These amino acids can by synthesized by the body and therefore. need not be supplied by an external diet. For ex. Alanine, aspartic acid.

Sol 10: (i) Vitamin A: Chief source orange, ripe yellow fruits, leafy vegetables, carrots, pumpkin Function. helps in vision, gene transcription, bone metabolism, antioxidant, activity.

(ii) Vitamin B: Chief source pork, oatmeal, brown rise, potatoes, eggs

Function. growth, regulation of apetite Functioning of heart, muscles and nervous system.

(iii) Vitamin D

(iv) Vitamin K

Sol 11: (i) Refer solution 9.

(ii) Refer solution 2.

Sol 12: Vitamin are classified into two groups.

Depending upon their solubility in water or fat.

(i) Fat soluble Vitamin: Vitamin which are soluble in fats and oils, but insoluble in water. for ex. Vitamin A,P,E and K

(ii) Water soluble vitamins: Vitamins which are soluble in water. For ex B group vitamins and vitamin C.

Vitamin K is responsible for coagulation of blood.

Sol 13: Function of vitamin A

(i) Vision

(ii) Gene transcription

(iii) Immune function

(iv) Bone metabolism

(v) Antioxidant activity

Deficiency causes night blindness.

Source: Liver, orange, carrots, pumpkin

Vitamin C

Function: Highly effective antioxidant

Lessen oxidative stress

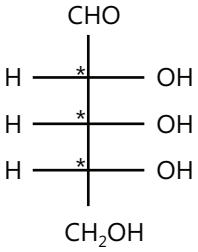
Natural antihistamine

Functioning of immune system

Deficiency causes scurvy, bleeding gums

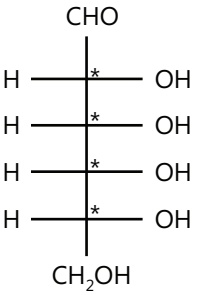
Sources: Virus fruits, amla, green leafy vegetable

Sol 14: Aldopentose



Asymmetric carbons are 3

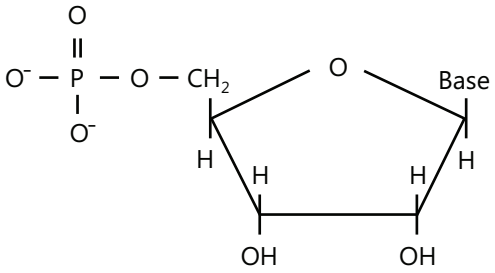
Aldohexose



Asymmetric carbons are 4

Sol 15: Nucleotides are organic molecules that serves as the monomers. Or subunits of nucleic acids like DNA or RNA

For E.g.



(b) (i) As a source of energy (more than 50–80% of energy in the diet is supplied by carbohydrates)

(ii) Protein sparing action: As carbohydrates are mainly used for energy need of body, proteins are spared for tissue building and repairing.

(iii) Essential for fat oxidation

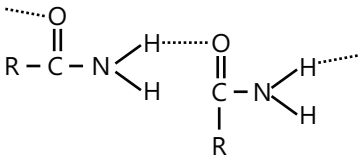
(iv) Gastro intestinal function.

Sol 16: α Helix structure is stabilized by the intra molecular hydrogen bond between the $>C = O$ group of one amino acid and $-NH$ group of the fourth amino acid.

Sol 17: Fibrous proteins have largely helical structure and are rigid molecules of rod like shape. Globular proteins, on the other hand have a polypeptide chain which consist partly of helical section and partly β pleated structure and Remaining random coil form.

Sol 18: (i) Amino acids have very strong intermolecular forces due to highly effective hydrogen bonding between

$>C = O$ and $-NH$ groups.



(ii) Vitamin A Night blindness Vitamin B_1 Beri Beri Vitamin B_6 Convulsions

Vitamin K increasing blood clotting time

Sol 19: In DNA, two nucleic acid chains are wound about each other held together by hydrogen bonds between pair of bases. The two strands are complementary to each other because the hydrogen bonds are formed between specific pair of bases. Adenine forms hydrogen bonds with thymine whereas cytosine forms hydrogen bonds with guanine.

Sol 20: (i) $\alpha-$Helix

(a) Alkyl groups in amino Acids are large.

(b)Polypeptide chains are coiled leading to right handed helical coil

(c)Stablised by intermolecular H – bonding between groups on one amino acid and –NH group of 4 amino acid.

$\beta-$Helix

(a) Alkyl groups in amino acids are small

(b) Polypeptide chains are arranged side by side

(c) Stabilized by intermolecular H-Bonding between the $>C = O$ and $-NH$ group.

(ii) (a) Primary Structure: This structure refer to its covalent structure which various sequence in which various $\alpha-$amino acids are arranged in protein or in the polypeptide structure of protein.

(b) Secondary Structure: This refers to the arrangement of polypeptide chains into a defined three dimension structure which protein assumes as a result of hydrogen bonding.

Sol 21: The particles in nucleus of the cell, responsible for heredity, are called chromosomes, which are made up of proteins, and another type of biomolecules called nucleic acids.

Function:

(i) Nucleic acid serves as chemical basis of heredity and may be regards regarded as reserve of genetic information.

(ii) Protein synthesis in cells.

Sol 22: Nucleoside:

(a) Consist of a nitrogenous base covalently attached to a sugar (ribose or deoxyribose) but without the phosphate group.

Nucleoside = sugar + base

(b) Used as antiviral or anticancer agents

(c) E.g. Cytidine, uridine, adenosine

Nucleotide:

(a) Consists of a nitrogenous base, a sugar (ribose or deoxyribose) and one to three phosphate groups.

(b) Nucleotide sugar + base + phosphate

(c) Malfunctioning nucleotides are one of the main causes of cancer.

E.g. S-uridine monophosphate

Sol 23: Reducing sugar: sugar that contain aldehyde group that are oxidized to carboxylic acids are classified as reducing sugar.

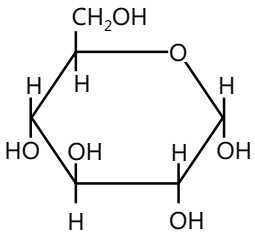
For e.g. Sucrose act as reducing agents.

Non reducing sugar: they cannot act as a reducing group due to absence of an aldehydic group.

Reducing sugars must either contain aldehyde group or in is capable of forming one in solution through isomerism.

Sol 24: α glucose

(a)

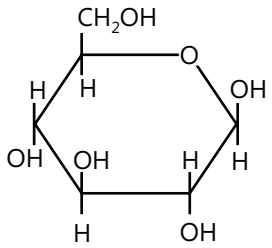


(b) $-OH$ group lies below the ring on carbon

(c) α glucose folds up into a helix.

β glucose

(a)



(b) $-OH$ group lies above the ring on carbon

(c) β glucose folds up into a pleated sheet.

Sol 25: Refer solution 1.

Same reaction as D-Glucose, only structural difference is in the configuration of atoms around different carbons.

Sol 26: Refer text pg. 15

Sol 27: Different types:

(i) mRVA

(ii) fRNA

(iii) rRNA

Sol 28: (i) This pH at which the structure of amino acid has no net charge is called it's isoelectronic point for ex. Aspartic acid hs isoelectric point of 2.77

(ii) Mutarotation is the change in the optical rotation that occurs by epimerization (change in equilibrium between two epimers, when the corresponding stereocentres interconvert) for ex. $\beta-D$ glucose.

With specific rotation of +18.7°, when dissolved in water undergo mutarotation and attains a final specific rotation of 52.5^0

(iii) An enzyme is a substance produced by a living organism which acts as a catalyst to bring about a specific biochemical reaction for ex. Streptokinase

Sol 29: Refer theory.

Sol 30: (a) Refer text Pg. 2

(b) A nucleotide is an organic molecule made up of nucleotide base, a five carbon sugar and at least one phosphate group.

The two classes are

(i) Purine: contains adenine and guanine

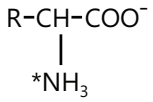
(ii) Pyrimidine: contains cytosine, thymine and uracil.

Exercise 2

Single Correct Choice Type

Sol 1: (D) Chromophore is the colouring agent, which is diazo group (–N = N -)

Sol 2: (D) Zwitter ion is present



Sol 3: (C) This is secondary structure of a protein

Sol 4: (C) General formula of carbohydrates:

$C_n(H_2O)_n$ or $C_x(H_2O)_y$

Sol 5: (A) Rest are all monosaccharide except sucrose.

Sol 6: (B) Iron is bonded by co-ordination ring formation (chelation)

Sol 7: (C) Anomers have different specific relation.

Sol 8: (A) Amide linkage $(-CO-NH-)$ is called peptide bond

Sol 9: (C) Glucose is a hydroxyl aldehyde whereas Fructose is a ketone.

Sol 10: (B) Glucose is a hydroxy aldehyde with 6 carbon or aldehexose.

Sol 11: (D) Phenol acts both as an antiseptic and disinfectant.

Sol 12: (C) Fenton's reagent (H_2O_2 + Fe) converts D -glucose (6 carbon) to D arabinose (5 carbon)

Sol 13: (D) At isoelectronic point.

$$pH = \frac{pk_{a1} + pk_{a2}}{2}$$

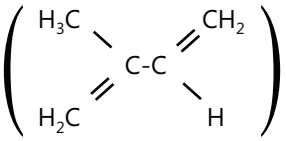
Sol 14: (A) Zeigler and Natta developed zeigler Natta Catalysts $(Al(C_2H_5)_3 + TiCl_3)$ which are used for coordination polymerization.

Sol 15: (C) Teflon is homopolymer of tetraflourethylene. Polystyrene is a homopolymer of styrene. Neoprene is a homopolymer of chloroprene.

Sol 16: (A) Anomer have different configurations at Glycosidic carbon and hence different specific rotation.

Sol 17: (A) They are called epimers.

Sol 18: (B) Natural rubber is polymer of isoprene



Sol 19: (B) It is called inversion as sucrose, which is dextrorotatory gives a laevorotatory mixture on dilution.

Sol 20: (B) Sulphur cross links are present in vulcanised rubber.

Sol 21: (A) Glycine $(H_2N - CH_2 - COOH)$ is the simplest amino acid.

Sol 22: (D) All of these are natural polymers.

Sol 23: (C) They differ in configuration of CI

Sol 24: (A) Aldehydic group gives silver mirror test with tollen's reagent.

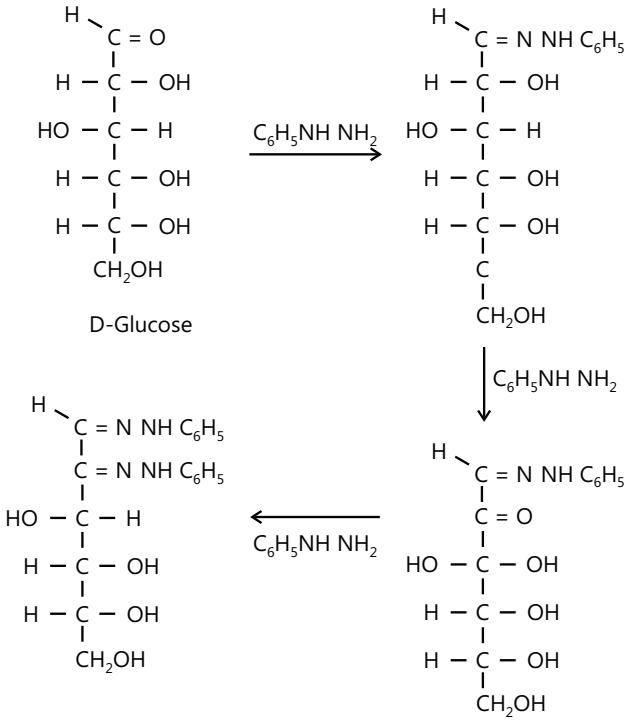
Sol 25: (A) This is definition of oligosaccharides.

Sol 26: (B) This is definition of epimer.

Sol 27: (C) Energy is evolved with ATP is hydrolysed to ADP and AMP. Rest are correct.

Sol 28: (B) Cellulose is a linear polymer of β glucose.

Sol 29: (A)



3 molecules of phenylhydrazine is used.

Sol 30: (C) Main structural unit is peptide linkage $(-CO-NH-)$

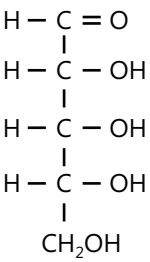
Sol 31: (D) All these are function of the proteins

Sol 32: (D) Glucose and galactose are monosaccharide while sucrose is disaccharide.

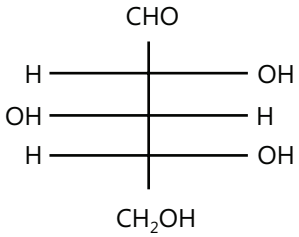
Sol 33: (C) Starch on reaction with iodine gives blue colour which serves as a test for presence of I_2

Sol 34: (C) Ribose has five carbon atoms, rest all options are correct.

Ribose



Sol 35: (C) D – xylose is a diastereomer of ribose with formula.



Sol 36: (A) Glucose gives the silver mirror test with ammoniacal solution of silver nitrate because it contains the group Aldehyde.

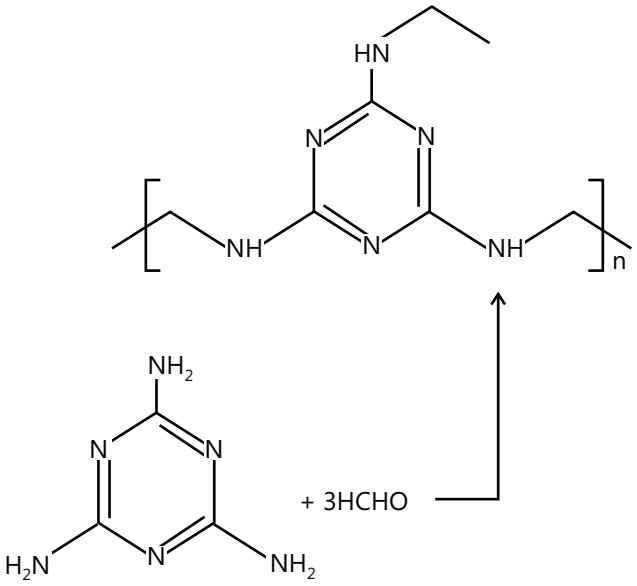
Sol 37: (A) Dacron is a copolymer of ethylene glycol and terephthalic acid.

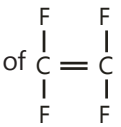
PVC is a polymer of : Vinyl chloride

Polystyrene is a polymer of styrene

Teflon is a polymer of tetraflouroethylene

Sol 38: (B) Melamine resin:



Sol 39: (C) Teflon is a polymer of 

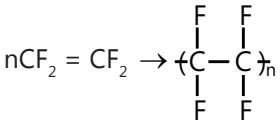
Sol 40: (D) Acrylonitrile n $H_2C = C - C \equiv N \rightarrow$

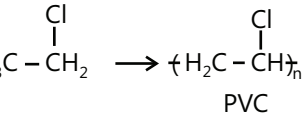
$\{HC = C - C = N\}_n$

Sol 41: (D) Glyptal is a condensation polymer.

Sol 42: (C) Highly vulcanised rubber is called ebonite.

Sol 43: (A) Teflon is a polymer of $F_2C = CF_2$



Sol 44: (A) 

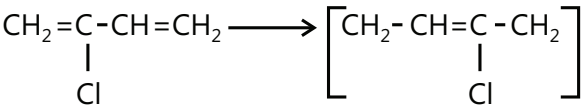
Sol 45: (D) Polyacrylonitrile is a polymer of acrylonitrile ($CH_2 = CHCN$)

Sol 46: (A) This is the classification based on inter molecular forces.

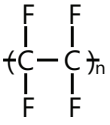
Sol 47: (C) Polyethene involves linear linkage between chains $\{CH_2 - CH_2\}_n$

Sol 48: (C) Al $(C_2H_5)_3$ + $TiCl_4$ is Zieglar – Nata catalyst

Sol 49: (B) Neoprene is a polymer of chloroprene

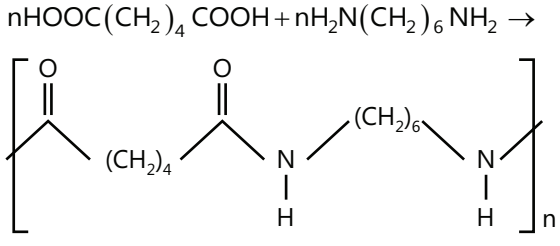


Sol 50: (B) Teflon is a polymer of $CH_2 = CF_2$.

Sol 51: (D) Polytetraflouroethylene or Teflon 

is used because of its being a thermoplastic polymer.

Sol 52: (A)



Sol 53: (C) They are made from a single compound i.e. they contain a single repeating unit.

Previous Years' Questions

Sol 1: (B) Both glucose and fructose are reducing sugars, reduces Tollen's reagent to metallic silver.

Sol 2: (B) "α" and "β" cyclic hemiacetals of D-glucose having difference in configuration at C-1 only are called anomers.

Sol 3: (C) Statement I is Correct: Presence of -CHO group in glucose is tested by Fehling solution test where a reddish-brown precipitate of Cu_2O is formed.

Hence, statement II is incorrect.

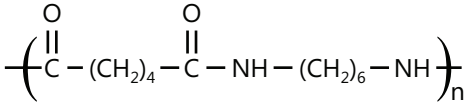
Sol 4: (C) $\alpha-D(+)$ glucose and $\beta-D(+)$ glucose are anomers.

Sol 5: (C) Carbohydrates are polyhydroxy carbonyl compounds.

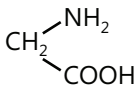
Sol 6: (C) Buna-N synthetic rubber is a copolymer of acrylonitrile (ACN) and butadiene.

Sol 7: (A) It is a test characteristic of amide linkage. Urea also has amide linkage like proteins.

Sol 8: (B) Nylon 6,6 is a polymer of adipic acid and hexamethylene diamine



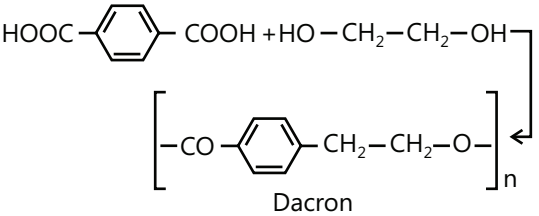
Sol 9: (A) In RNA, the sugar is $\beta-D$ -Ribose, where as in DNA the Sugar is $\beta-D-2$ - deoxy Ribose.

Sol 10: (C) Glycine 

Sol 11: (A) Fact

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

Sol 12: (A) Dacron is polyester formed by condensation polymerisation of terephthalic acid and ethylene glycol



Dacron

Acrylonitrile, Neoprene and Teflon are addition polymers of acrylonitrile, isoprene and tetrafluoro ethylene respectively.

Sol 13: (A) DNA contains ATGC bases

A – Adenine

T – Thymine

G – Guanine

C – Cytocine

So quinoline is not present.

Sol 14: (B) Glyptal is used in the manufacture of paints and lacquers.

Sol 15: (A) Vitamin B and C are water soluble and Vitamin A, D, E and K are water insoluble.

Sol 16: (C) Low density polythene is not used in the manufacturing of buckets, dust-bins etc. because buckets, dustbins are manufactured by high density polythene.

Sol 17: (A)

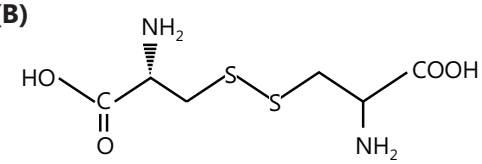
Sodium lauryl sulphate = detergent, anionic

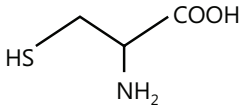
Cetyltrimethyl ammonium bromide = detergent, cationic

Glyceryl oleate = detergent, non-ionic

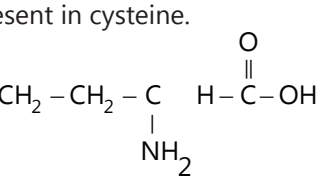
Sodium stearate = soap, anionic

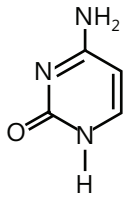
Sol 18: (B)

Cystine 

Cysteine 

Thiol group (SH) is present in cysteine.

Methionine 

Cytosine 

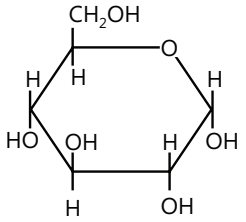
JEE Advanced/Boards

Exercise 1

Sol 1: Streptokinase is used as a medicine for blood clots.

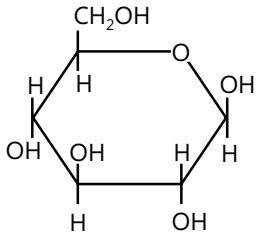
Sol 2: Cellulose in our diet is not nourishing as because, it is a complex from of carbohydrate, and no mammal makes the necessary enzyme to break down cellulose.

Sol 3: Mutarotation is the change in the optical rotation that occurs by epimerization (that is the change in he equilibrium between two epimers, when the corresponding stereo centers interconvert epimers of D-glucose



α – D – (+) – Glycopyranose

θ = +112°C



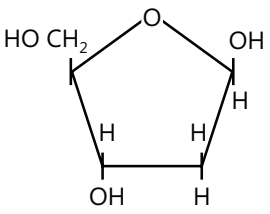
β – D – (+) – Glycopyranose

θ = 19°C

When either of these forms of D-glucose is dissolved in water and allowed to stand, a gradual change in specific rotation occurs the specific rotation of the α form falls and that of the β form rises until a constant values of 53° is obtained.

Sol 4: For differences, refer text.

Sugar: 2 – deoxy D(–)ribose



Sol 5: (i) Proteins are polymer of α–amino acids and they are connected to each other by peptide bond or peptide linkage.

(ii) A polypeptide is a single linear chain of amino acids whereas an oligopeptide is a polypeptide less then

30-50 amino acids long.

(iii) Refer Exercise I, Q.6

Sol 6: A vitamin is an organic compound required by an organism as a vital nutrients in limited amounts.

(a) Two types Fat Soluble Vitamins: Vitamins which are soluble in fat and oil, but insoluble in water for E.g. Vitamin A,D,E And K

(b) Water Soluble Vitamin: Vitamins which are soluble in water, for Ex. B group vitamins and vitamins C

(b) Refer theory part.

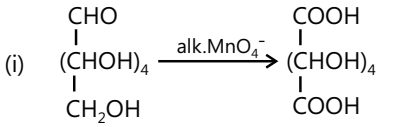
Sol 7: (a) (i) A coenzyme is a substance that works with an enzyme to initiate or aid the function of enzyme. They can not function on their own and require the presence of an enzyme.

Sol 8: (a) (i) Oranges, carrots, pumpkins

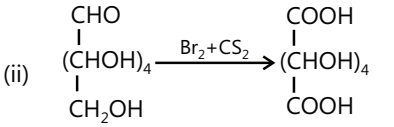
Sol 9: (i) Cellular Respiration: Like other organisms, plants store corbohydrates and burn them for energy.

(ii) Mechanical Strength: Certain carbohydrats, like cellulose helps plants in enhancing mechanical strength.

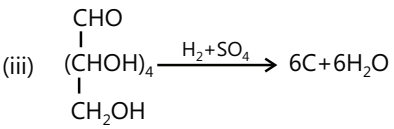
Sol 10: (i)



Saccharic acid



Gluconic acid



Sol 11: (i) Adenine (ii) Thymine (iii) Cystosine

(iv) Guanine

Thymine is not present in RNA.

Sol 12: Two fat soluble vitamin are vitamin A and D.

Vitamin A: Deficiency disease night blindness.

Sources: (i) Carrots (ii) Liver (iii) Pumpkin (iv) Orange

Vitamin D: Deficiency disease: Rickets sources.

(i) Sunlight (chief source)

(ii) Some mushrooms

Sol 13: Refer theory.

Sol 14: Refer Exercise I, two (ii)

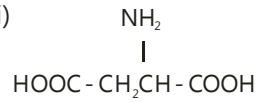
Sol 15: (a) Functional group

(i) Carboxylic acid (ii) Amine

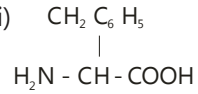
Amide Ester

(b) $^{-}OOC\text{-}CH_2\text{-}\underset{\displaystyle NH_3^+}{\underset{|}{CH}}\text{-}CONH\text{-}\underset{\displaystyle CH_2C_6C_5}{\underset{|}{CH}}\text{-}COO\,CH_3$

(c) (i)



(ii)



(d) (ii) is more hydrophobic as (i) is more polar due to presence of 2 COOH groups,

Helping, (i) to make hydrogen bonds with water, increasing its hydrophilicity

Sol 16: α – (5, 6 –dimenthylbenzimidazolyl)

Cobamidcyanide more commonly called cobalmin.

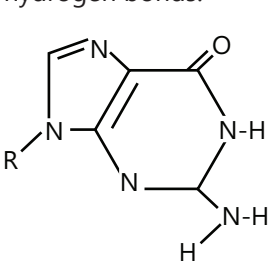
Sol 17: (a) A mixture of equal parts of glucose and fructose resulting from the hydrolysis of sucrose is called invert sugar.

(b) Polypeptide is a linear organic polymer consisting of a large number of amino acid residues bonded together in a chain, forming part of (or the whole of) a protein molecule.

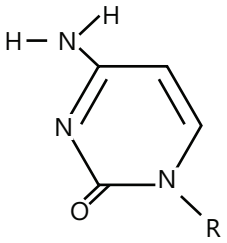
Sol 18: Intramolecular Hydrogen bonding is between C=O group of one amino acid and –HN group of fourth amino acid stabilises α–helix structure.

In 3.6_{13}–Helix, 3.6 is the number of residues per turn and 13 is the number of atoms in the hydrogen bonded loop.

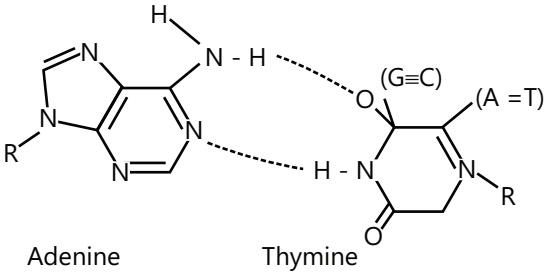
Sol 19: Complementary bases are specific pairs that join up the two strands of double stranded DNA Via hydrogen bonds.



Guanine

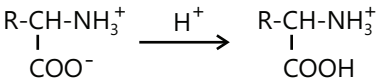


Cytosine



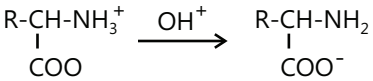
Adenine Thymine

Sol 20: (i) In acidic medium,



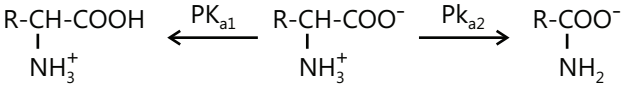
Since this is a positively charged ion (cation), they migrate towards the cathode.

In basic medium,



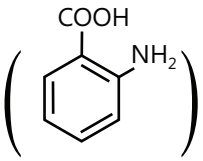
Since this is an anion (negatively charged), they migrate towards the anode.

(ii)Monoamino carboxylic acids exits as zwitter ions and exhibit two different k_a values and hence two pk_a values.

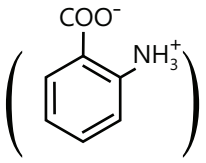


Sol 21: Glycine ($H_2N - CH_2 - COOH$) exists as zwitter ion ($H_3N - CH_2 - COO^-$) as it contains both acid and

amino group on the same α – Carbon

Anthranilic acid 

Cannot exist as zwitter ion, because

The resulting zwitter ion 

is highly destabilised by the strong +I And no m-effect of NH_3^+ group.

Sol 22: Refer theory Part.

Sol 23: Refer theory Part.

Sol 24: Refer theory Part.

Exercise 2

Biomolecules

Single Correct Choice Type

Sol 1: (A) In complementary strand, complementary bases will be present, that is according to pairing (A = T) and (C = G). Now

DNA strand.

A T G A C T G T C
‖ ‖ ||| ‖ ||| ‖ ||| ‖ |||
T A C T G A C A G

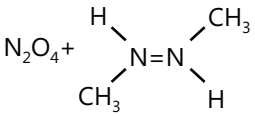
Complementary strand

Sol 2: (C) Saturated acids have high melting point due to low bond polarity

Sol 3: (D) Biodegradable detergent should contain a cyclohexyl side chain.

Sol 4: (C) The gases ejected by the rocket exert an equal and opposite thrust on the rocket.

Sol 5: (A)

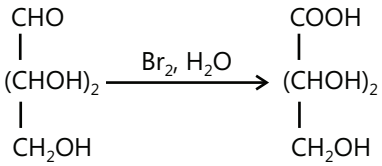


(unsymmetrical dimethyl hydrazine)

Is used as bi liquid propellant in rocket fuels.

Sol 6: (C) In 'placebo', a group of patients is given an actual medicine, while the other group is given an ordinary sugar pill. The ordinary pill is called placebo.

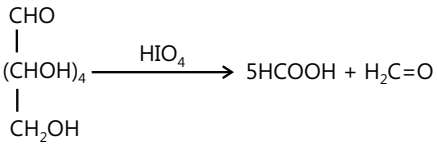
Sol 7: (D)



Glucose

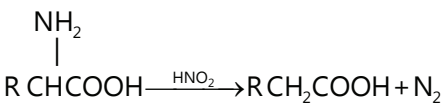
Fructose does not undergo any reaction.

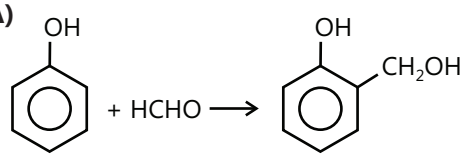
Sol 8: (A)



Sol 9: (D) This is correct.

Sol 10: (B) Amino acids give minhydrin test as they are primary amines.

With HNO_2, 

Sol 11: (A) 

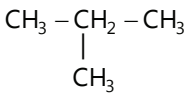
This is an electrophilic substitution.

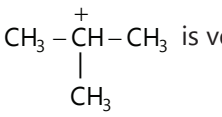
Sol 12: (A) Average molecular mass = $\frac{\Sigma N_i M_i^2}{\Sigma N_i M_i}$

Sol 13: (C) Polydispersity index

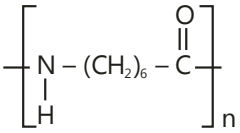
$$= \frac{\text{Weight Average Molecular Mass}}{\text{Number Average Molecular Mass}} = \frac{\frac{\Sigma N_i M_i^2}{\Sigma N_i M_i}}{\frac{\Sigma N_i M_i}{\Sigma N_i}}$$

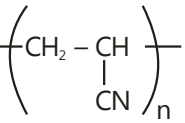
$$= \frac{\Sigma N_i \times \Sigma N_i M_i^2}{\left(\Sigma N_i M_i\right)^2}$$

Sol 14: (C) Isobutane 

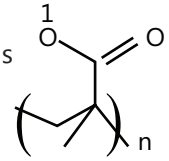
We see then its cation  is very stable,

as it is tertiary, therefore the best way to polymer it is by cationic polymerization.

Sol 15: (B) Nylon-6 : 

Sol 16: (D) Acrilan 

Sol 17: (D) They are all correct.

Sol 18: (D) Commercial name for polymethylmethacrylate, is 

plexiglass (orperpox)

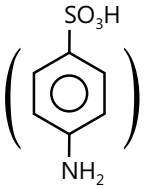
Multiple Correct Choice Type

Sol 19: (B, C) Self explanatory.

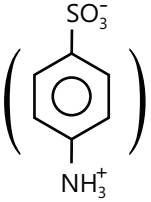
Sol 20: (B, C, D)

(a) At isoelectric point, amino acid solution is neutral.

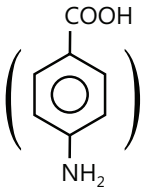
(b) ϕ-amino benzesulphonic acid



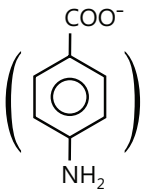
exists as dipolar ion



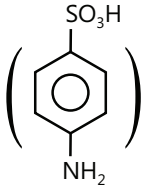
Due to very high acidity of $-SO_3H$ group and stabilisation of resulting dipolar ion due to charge distribution. In p – aminobenzoic acid

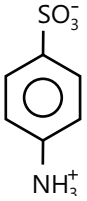


the resulting dipolar ion



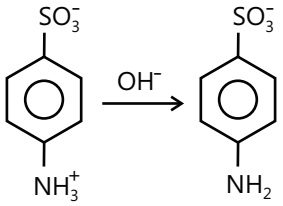
Does not exist as relatively low acidity of –COOH group and less stablisation of dipolar ion, as negative charge is distributed between only 20 atoms.

(c) Sulphanilic acid 

Exists as dipolar ion, 

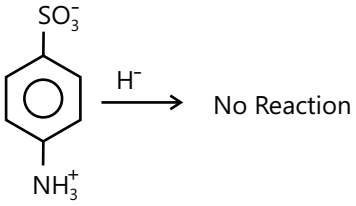
Which is an insoluble salt.

Now in base,



Reacts with base as OH^- is more basic than $^-NH_2$ group.

In acid,

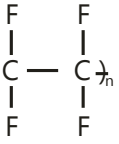


No reaction, as H^+ is less acidic than $^-SO_3H$ group.

(d) Since pK_a of $H_3N^+CH_2COOH$ is less than pK_a of RCH_2COOH, it is more acidic

Sol 21: (B, C, D) Polyethylene contains single bonds only.

Polyethylene : $\{CH_2 - CH_2\}_n$

Teflon : 

(C) and (D) are correct

Assertion Reasoning Type

Sol 22: (A) Strach $\xrightarrow[\text{Amylase}]{}$ Maltose

Starch contains glycosidic linkage which are broken down by amylase.

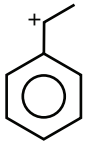
Sol 23: (C) On hydrolysis, sucrose ($\theta = 66.47°$) gives equal amount of glucose ($\theta = 52.5°$) and fructose ($-92.4°$). Thus total specific rotation of mixture is $-39.9°$ which makes it laevorotatory, whereas the initial solution was dextrorotatory.

$$\text{Sucrose} \rightarrow \text{Glucose} + \text{Fructose}$$
$$\theta = 66.47^0 \qquad \theta = 52.5^0 \qquad \theta = -92.4^0$$

Sol 24: (C) A is correct

R is wrong as $\alpha-$Helix is stabilised via intramolecular hydrogen bonding between –CO of one amino acid and –NH group of fourth amino acid

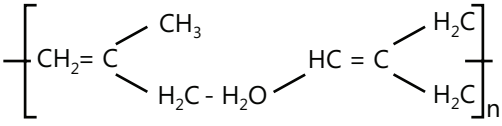
Sol 25: (C)

Carbocation form styrene 

Carbocation from propylene $CH_3\text{-}\overset{+}{H}C\text{-}CH_3$ (ii)

(i) is more than (ii) as it is resonance stabilised through conjugation with benzene ring.

Sol 26: (C) Natural rubber is all cis-polyisoprene.

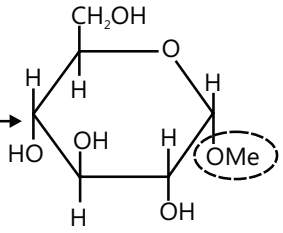


Trans-Polyisoprene can be formed but is generally not found naturally.

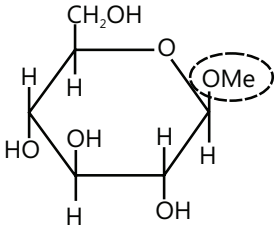
Sol 27: (A) PMMA (Poly (Methyl methacrylate) has excellent light transmission properties as it is transparent and thus used for making lanses end light covers.

Sol 28: (D) Vinyl alcohol, $H_2C = CH - OH$ is unstable

and converts to $H_3C-\overset{\overset{O}{\|}}{C}H$. Therefore, poly vinyl alcohol is prepared by hydrolysis on polyvinyl acetate.

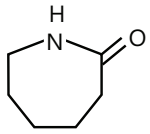
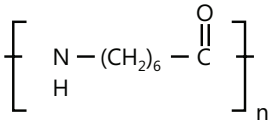
D-Glucose $\xrightarrow{\text{MeOH/HCl}}$ 

Methyl-α-D (+) glucopyranoside

\+ 

Methyl-β-D (+) glucopyranoside

Sol29: (B) It is a polyamide

 $\longrightarrow$ 

Caprolactum Nylon-6

Comprehension Type

Paragraph 1:

Sol 30: (A) Elastomers have weakest forces of attraction e.g. rubber.

Sol 31: (A) Thermoplastics usually have a linear structure which allows them to be repeatedly softened (or hardened) by an increase (decrease) in temperature.

Sol 32: (D) Thermosetting polymers are hard due to three dimensional network of bonds.

Paragraph 2:

Sol 33: (A) Rubber on reaction with sulphur forms vulcanized rubber which is shift and resistant to action of common solvents and wear and tear.

Sol 34: (C) This process is called vulcanisation.

Match the Columns

Sol 35: (B) Nucleic acids are polynucheotides uracil is found only in RNA.

Thymine is found only in DNA, DNA has double helix structure.

Sol 36: (C) Pepsin is a digestive enzyme Nucleic acid contains genetic material Ascorbic acid is chemical name for vitamin C. Testosterone is a sex hormone.

Sol 37: (B) Bakelite is copolymer of phenol and methanol dacron is copolymer of 1, 2-dihydroxyethane and dimethylterephthalate.

Nylon-66 is a copolymer of 1, 6-hexanedioic acid and 1, 6-diaminol hexane.

(o) Buna-S is copolymer of butadiene and styrene.

Sol 38: (C)

Polymer	Monomer
Bakelite	Phenol and formaldehyde
Terylene	Terephthalic acid and ethylene glycol
Nylon-6	Caprolactam
Synthetic rubber	Butadiene and styrene

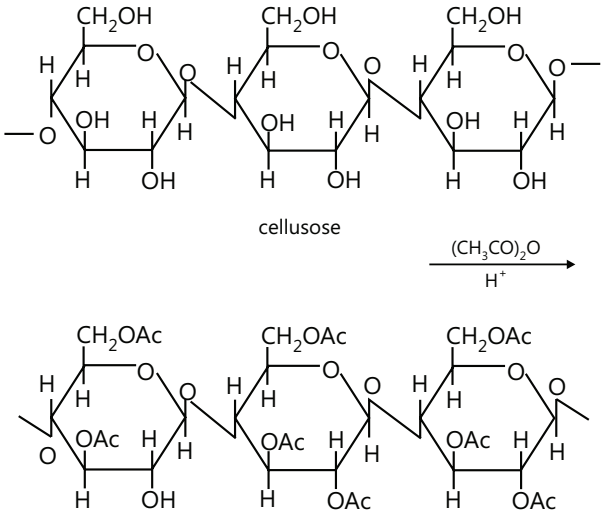
Sol 39: (B)

Polymer	Monomer
Nylon-66	Hexamethylene diamine + adipic acid
Bakelite	Phenol and formaldehyde
Glyptal	Phthalic acid and ethylene glycol
Dacron	Terephthalic acid and ethylene glycol.

Previous Years' Questions

Sol 1: (A) Cellulose is biopolymer of

β -D –glucopyranose as:



Sol 2: (B) 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, ie, van der Waals' force of attraction.

Sol 3: (A) 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.

Sol 4: (B) Here, the –OH of hemiacetal group is equatorial therefore, it is a β -pyranose of an aldohexose.

Sol 5: (B, C) 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.

Sol 6: (B, C)

(A) False (B) Factual

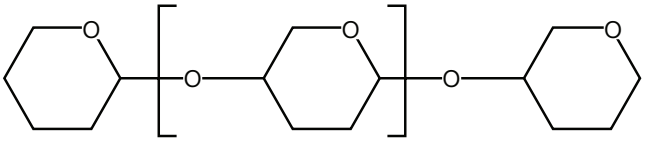
(C) $\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[\text{Invertase}]{H^+} \underset{\text{D-Glucose}}{C_6H_{12}O_6} + \underset{\text{D-Fructose}}{C_6H_{12}O_6}$

Net specific Rotation of an equimolar mixture of

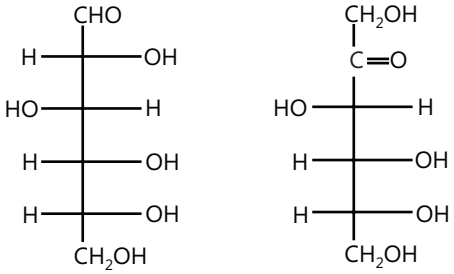
$$\text{Invert} = \frac{52 - 92}{2} = \frac{-40}{2} = -20$$

Sol 7: A → p, s; B → q, r; C → p, r; D → s

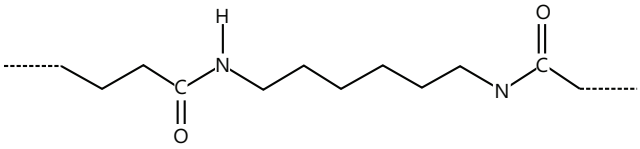
(A) Cellulose



(Glycoside linkage)

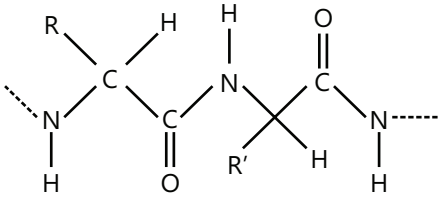


(B) Nylon 6, 6



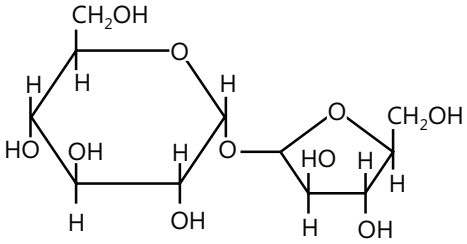
(Amide linkage)

(C) Protein



(Amide linkage)

(D) Sucrose



(Glycoside linkage)

Sol 8: $-COO^-$ and $-NH_2$ are basic groups in lysine.

Sol 9: A decapeptide has nine peptide (amide) linkage as -

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

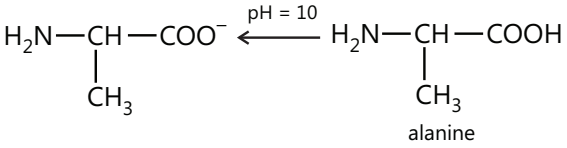
Hence, total mass of hydrolysis product

$= 796 + 18 \times 9 = 958$

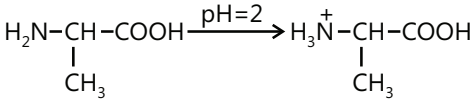
$\Rightarrow$ Mass of glycine in hydrolysis product $= \frac{958 \times 47}{100} = 450$

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

Sol 10:



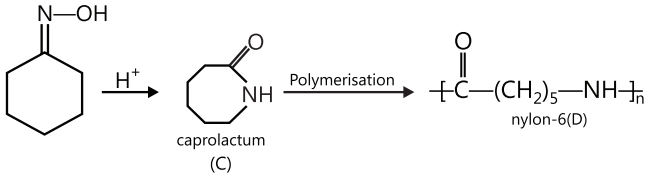
alanine



Alanine

Sol 11: Sucrose $\xrightarrow[H_2O]{H^+}$ D-glucose + D –fructose

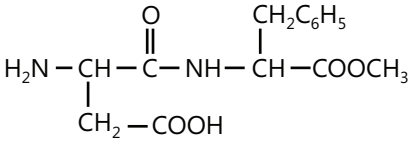
Sol 12:



caprolactum (C)

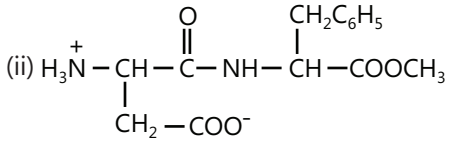
nylon-6(D)

Sol 13:

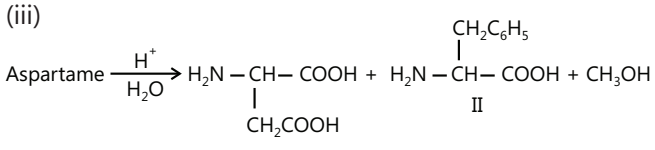


aspartame

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

(ii) 

(iii)



I II

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

Sol 14: Zeigler-Natta catalyst, which is a mixture of triethylaluminium "$(C_2H_5)_3Al$" and $TiCl_4$, is used as heterogeneous catalyst in polymerization of ethylene.

Sol 15: (C)

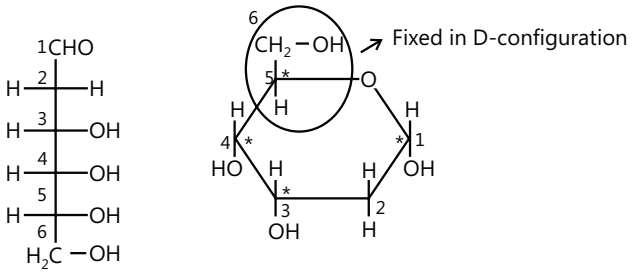
$$C_6H_{12}O_6 + \text{Fehling solution} \longrightarrow (C_6H_{11}O_7)^- + \underset{\text{(Red ppt.)}}{Cu_2O\downarrow}$$

Sol 16: (A) As in cellulose $\beta\,1-4$ glycosidic linkage is present.

Sol 17: (D) Peptides with isoelectric point (pI) > 7, would exist as cation in neutral solution (pH = 7).

IV, VI, VIII and IX

Sol 18:



Hence total number of stereoisomers in pyranose form of D-configuration $= 2^3 = 8$

Sol 19: Because –COOH group of tetrapeptide is intact on alanine, its NH_2 must be participating in condensation.

$\therefore$ Alanine is at one terminus, – – –A.

To fill the 3 blanks, possible options are:

(i) When NH_2 group attached to non chiral carbon

G	V	P
G	P	V

(ii) When NH_2 group attached to chiral carbon

V	G	P	P	V	G
V	P	G	P	G	V

where, Glycine (G)

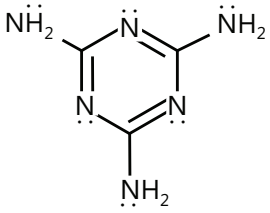
Valine (V)

Phenyl alanine (P)

Alanine (A)

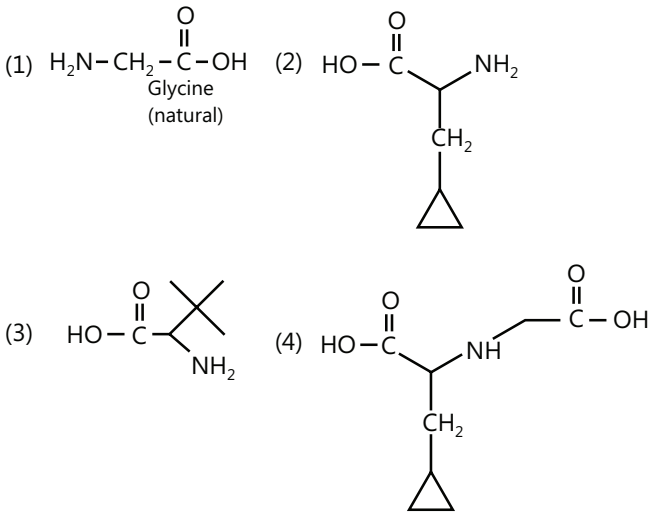
So the number of possible sequence are 4.

Sol 20: lone pairs



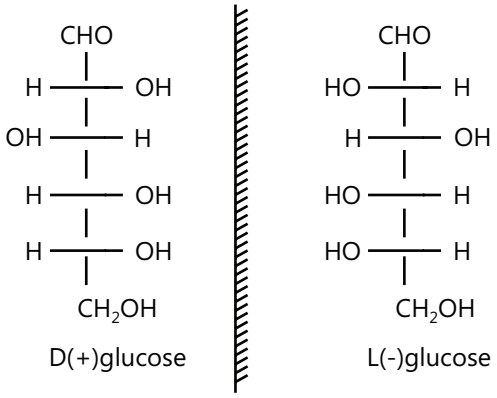
Melamine

Sol 21: This peptide on complete hydrolysis produced 4 distinct amino acids which are given below:

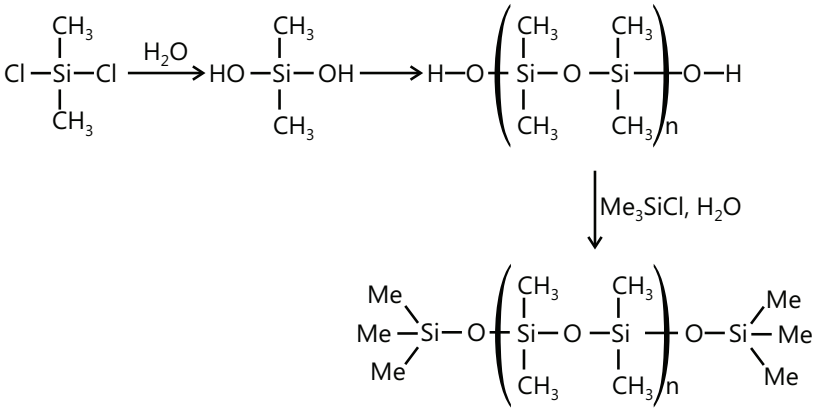


Only glycine is naturally occurring amino acid.

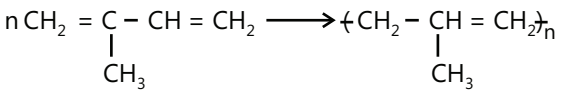
Sol 22: (A)



Sol 23: (B)



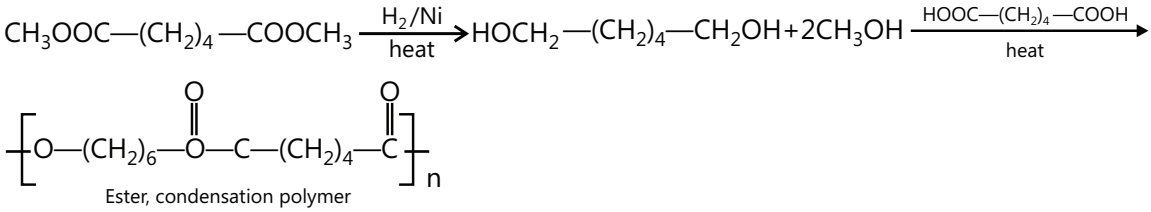
Sol 24: (A)



Natural Rubber

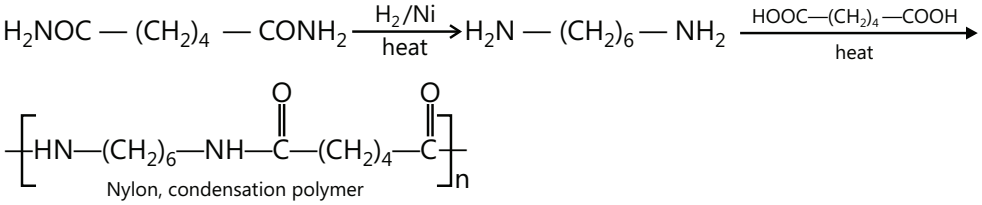
Sol 25: (C, D)

(a) When X = $COOCH_3$

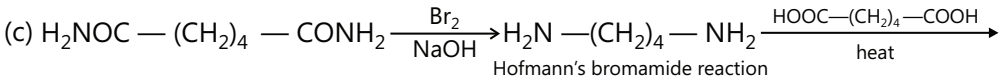


Ester, condensation polymer

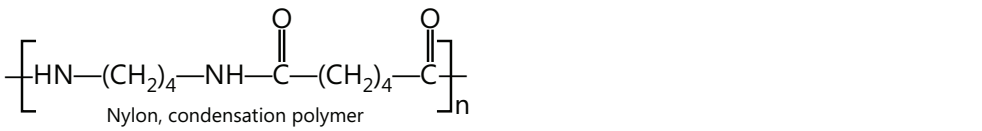
(b) When X = $CONH_2$



Nylon, condensation polymer

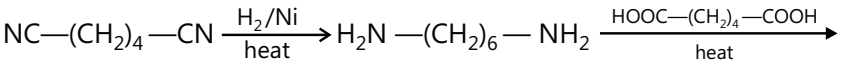
(c) 

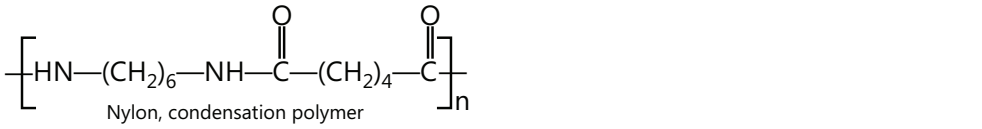
Hofmann's bromamide reaction



Nylon, condensation polymer

(d) When X = $CONH_2$





Nylon, condensation polymer