SOME IMPORTANT CARBOHYDRATES

1. **Sucrose** ($C_{12}H_{22}O_{11}$) **:** $\rightarrow$ A dimer of α-D-Glucose & β-D-Fructose. It is white, crystalline & sweet substance soluble in water obtained from the sugar cane. When heated above its melting point. It forms a brown substance known as caramel.

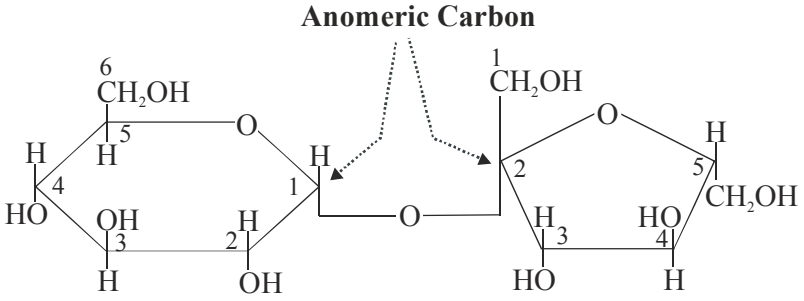
It's aqueous solution is dextrorotatory $[\propto]_D = +66.5°$

$$CH_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} \underset{\substack{\text{D-Glucose}\\ \alpha\,[D] = -52.7°\\ \text{Dextro Isomer}}}{\text{dextro } C_6H_{12}O} + \underset{\substack{\text{D-Fructose}\\ [\beta]_D = -92.7°\\ \text{Laevo Rotatary}}}{\text{laevo } C_6H_{12}O}$$

↓

Mixture is laevorotatory
$-20°$

- Thus hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to leavo (–) & such a change is known as inversion of sugar and the mixture obtained on acidic hydrolysis is known as *invert sugar*.
- The inversion of cane-sugar may also be done by the enzyme invertase which is found in yeast.
- Sucrose is non-reducing sugar because it has stable acetal linkage & in aq. solution it does not give free carbonyl group and so it does not reduces Tollen's & Fehling's solution.
- This indicates that neither the aldehyde group of glucose nor the ketonic group of fructose is free in sucrose.



Structure of sucrose
(α–D–glucopyranosyl–β—D–fructofuranoside)

Do not show mutarotation .

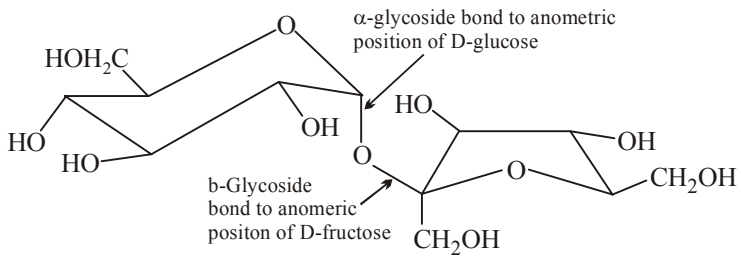


Fig. Showing Sucrose in other structure

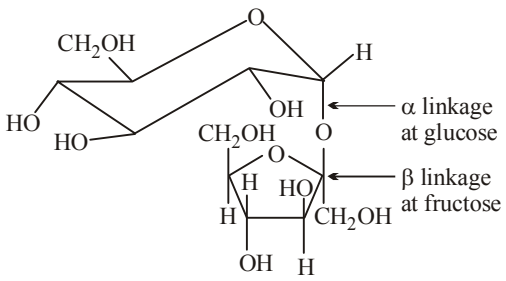


Fig. Showing Sucrose in other structure

2. Maltose :

- It is dimer of α-D-Glucose

It is obtained by partial hydrolysis of starch by the enzyme diastase present in malt i.e., sprouted barely seeds.

$$2\,(C_6H_{10}O_5)_n + n\,H_2O \xrightarrow{\text{Diastase}} n\,C_{12}H_{22}O_{11}$$

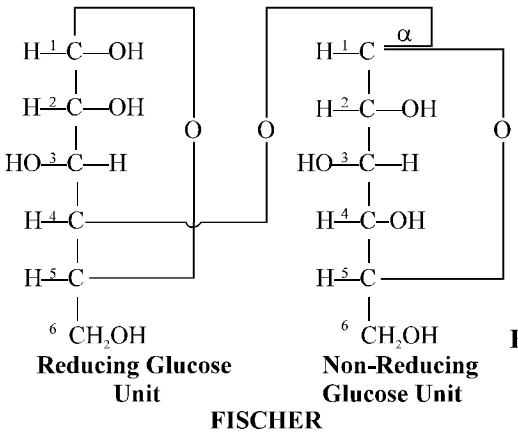
Starch Maltose

- Hydrolysis of one mole of maltose yields two moles of D-glucose.
- Maltose is a reducing sugar since it forms an osazone, undergoes mutarotation and also reduces Tollen's reagents and Fehling's solutions, Methylation studies have revealed that

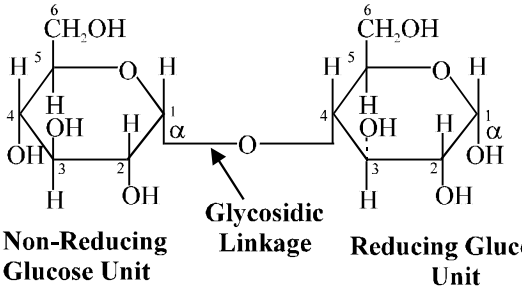
(i) Both glucose units are present in the pyranose form.

(ii) C_1 of one glucose unit is linked to C_4 of the other

Further since maltose is hydrolysed by the enzyme maltose which specifically hydrolyses α-glycosidic linkage, therefore, the non-reducing glucose unit in maltose must be present in the α-form. In other words, C_1 – α of non-reducing glucose unit is attached to C_4 of the reducing glucose unit as shown in the figure on next page.



FISCHER



HAWORTH PROJECTION FORMULAE OF α-D-MALTOSE

3. Lactose (Milk sugar) $C_{12}H_{22}O_{11}$

Lactose occurs in milk and that is why it is called milk sugar.

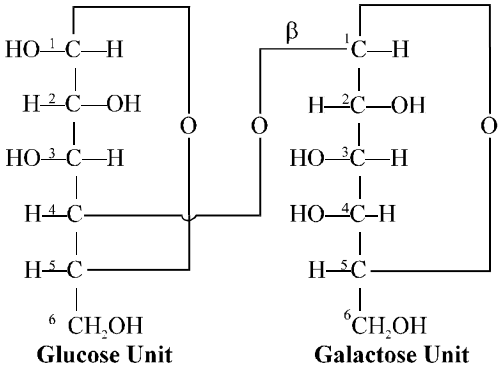
Lactose on hydrolysis with dilute acid or by enzyme lactase, yields an equimolar mixture of D-glucose and D-galactose. It is a reducing sugar it forms an osazone, undergoes mutarotation and also reduces Tollen's or Fehling's solution. Methylation studies have revealed that

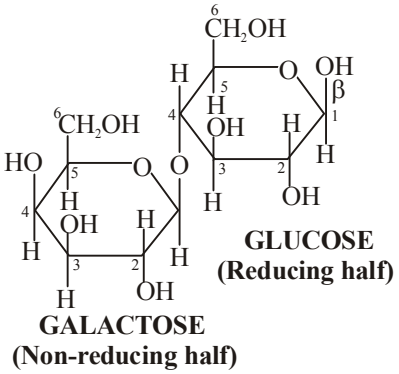
(i) both glucose and galactose are present in the pyranose form.

(ii) glucose is the reducing half while β-galactose is the non-reducing half.

(iii) C_1 of galactose unit is connected to C_4 of glucose unit.

Further since emulsin, as, enzyme which specifically hydrolyses β-glycosidic linkages also hydrolyses lactose, therefore, galactose must be present in the β-form. In other words, in lactose, C_1 – β of galactose is attached to C_4 of glucose as shown in figure.



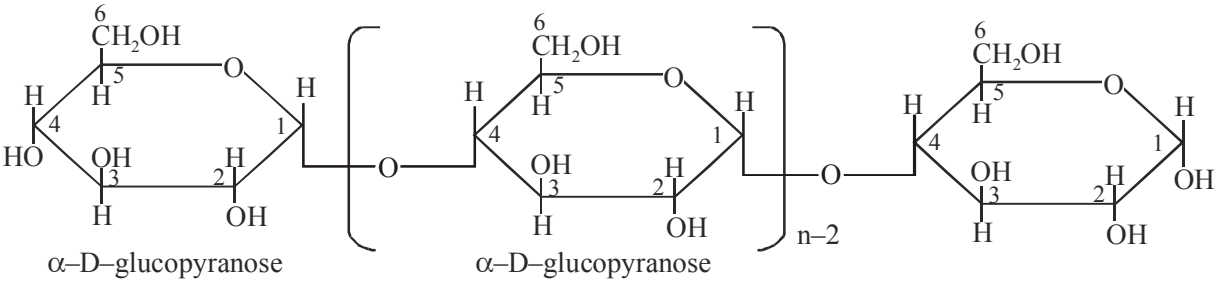


FISCHER

4. Starch Amylum, $(C_6H_{10}O_5)_n$

Occurrence : The value of n (100 – 3000) generally hewever it may varies from source to source. It is the chief food reserve material or storage polysaccharide of plants and is found mainly in seeds, roots tubers wheat, maize, rice, potatoes, barley, bananas and sorghum are the main sources of starch. Starch occurs in the form of granules, which vary in shape and size depending upon their plant source.

Occurs in all green plants.Starch consists of two fractions, one being known as (amylose), which gives blue colour with iodine. This blue colour is believed to be due to the formation of an inclusion complex. An aqueous solution of α–amylose slowly forms a precipitate, since α-amylose has a strong tendency to 'revert' to the insoluble state in solution. Amylopectin is insoluble in water and is stable towards both hydrolysis to maltose by the enzyme diastase and to D(+)-glucose by dilute acids (amylopectin gives about 50 percent of maltose).



Structure of Starch (α–D–glucoamylose)

α–amylose consists of an unbranched chain, with a molecular weight varying between 10,000($n \approx 60$) and 10,00,000($n \approx 6{,}000$), The value of n depends on the source and treatment of α–amylose.

Properties : (i) Starch is a white amorphous powder sparingly soluble in water. Its aqueous solution gives a blue colour with iodine solution due to the formation of an inclusion complex. The blue pears on cooling. (ii) On hydrolysis with dilute mineral acids or enzymes, starch beaks down first to smaller molecules (n > n'), then to maltose and finally to D-glucose.

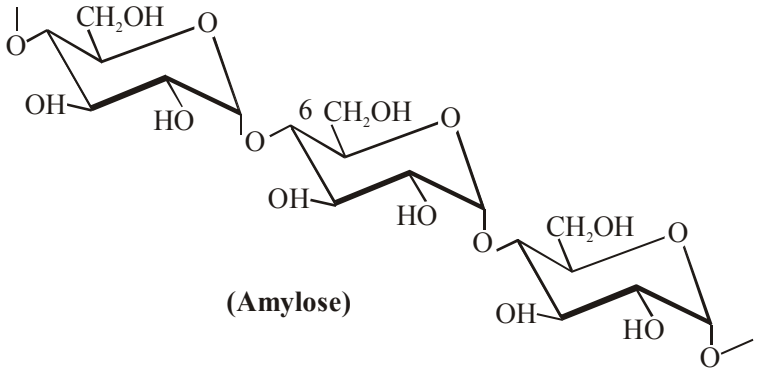
$$(C_6H_{10}O_5)n \xrightarrow{H^+/H_2O} (C_6H_{10}O_5)_{n'} \xrightarrow{H^+/H_2O} C_{12}H_{22}O_{11} \xrightarrow[\text{or Maltase}]{H^+/H_2O} C_6H_{12}O_6$$

Starch Maltose D-Glucose

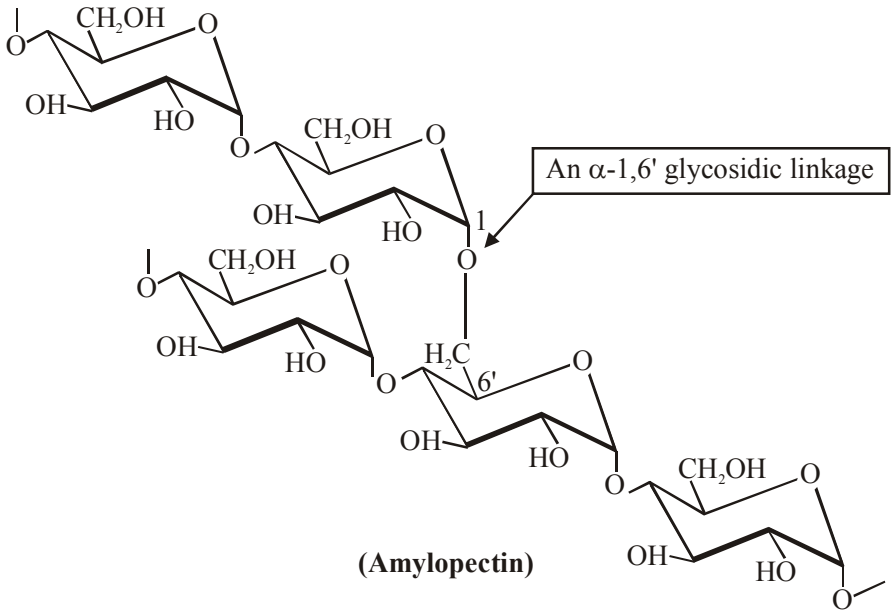
(iii) Starch is a non-reducing saccharide. It neither reduces Tollen's reagent or Fehling's solution nor forms an osazone. This suggests that all hemiacetal OH groups of glucose units at C_1 are not free but are involved in glycosidic linkages.

Composition : Starch is not a single compound but is a mixture of two components–a water soluble component called amylose (10-20%) and a water insoluble component called amylopectin (80-90%). Both amylose and amylopectin are polymers of α-D-glucose.

Structure of amylose : Amylose is water soluble and gives blue colour with iodine solution. It may have 100-3000 glucose units, i.e., its molecular mass can vary from 10,000 to 500,000. It is a linear polymer of α-D-glucose in which C_1 of one glucose unit is attached to C_4 of the other through α-glycosidic linkage as shown in figure.



(Amylose)



(Amylopectin)

Pectins

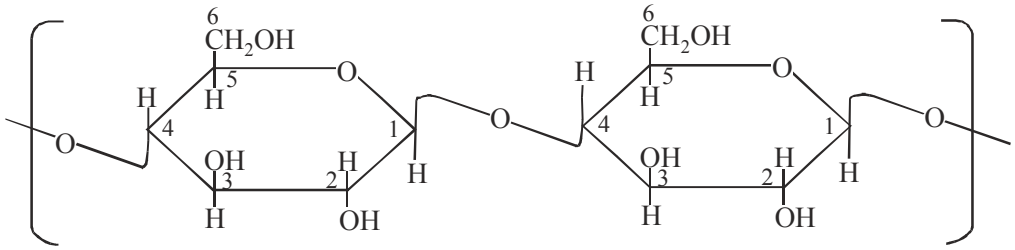
Pectins are found in plant and fruit juices. Their characteristic property is the ability of their solutions to gelate, i.e. form jellies. They have a high molecular weight and are polygalacturonic acid (linked 1,4) with the carboxyl groups partially esterified with methanol.

Glycogen $(C_6H_{10}O_5)_n$:

Glycogen is found in nearly all animals cells, occurring mainly in liver. It is the reserve carbohydrate of animals and so is often known as 'animal starch'. It has also been isolated from plant sources. Glycogen is a white powder, soluble in water, the solution giving a purplish-red colour with iodine. On hydrolysis with dilute acid, glycogen gives D(+)-glucose. The molecular weight of glycogen has been given as 10,00,000 to 50,00,000 and glycogen contains highly branched chains. Glycogen has a structure similar to amylopectin, except that it has more cross-linking.

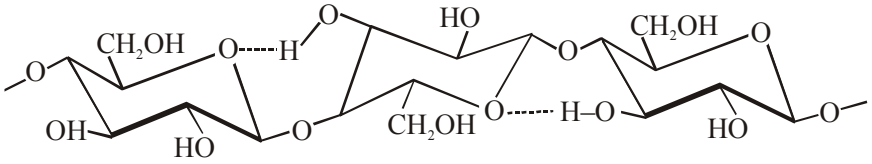
5. Cellulose:

Cellulose is colourless, solid which is insoluble in water & organic solvents. But it is soluble in ammonical cupric hydroxide (Schweizer's reagent) or in conc. HCl cellulose is a regular polymer of d-glucopyranose residues connected by β-1,4 glycosidic linkages. It is straight chain polymer.



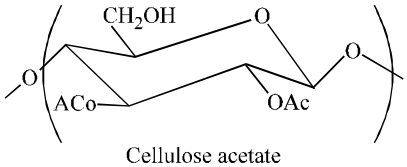
β–D–glucopyranose β–D–glucopyranose

(Structure of Cellulose)



Some points about cellulose :

1. General empirical formula $(C_6H_{10}O_5)$
2. Cellulose + $H_2O \xrightarrow{H^+}$ 96% of crystalline D-glucose
3. No. of monomer units in cellulose are 1000 – 1500 in one molecule.
4. Cellulose doesn't show mutarotation (like starch)
5. It is non reducing sugar because there is no hemiacetal linkage.
6. Acetylation, nitration & methylation of cellulose give trisubstituted cellulose which suggest that only three – OH groups are free.



Cellulose acetate

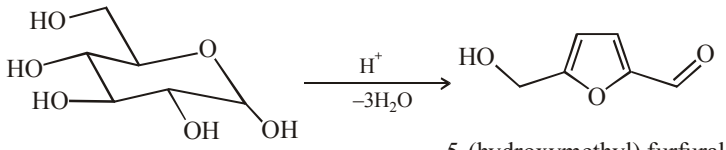
TEST OF CARBOHYDRATES

1. Molish Test
2. Barfoed Test
3. Salivanoff's Test.
4. Bial's Test
5. Osazone Test
6. Benedict Test
7. Fehling Test
8. Tollen's Test
9. Iodine Test

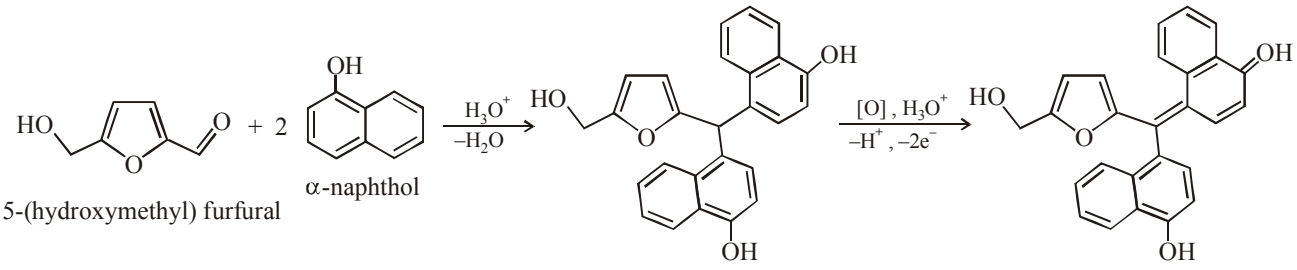
1. Molish Test

Molish test is the general test for the identification of all carbohydrates (Monosaccharides, Disaccharides and Poly saccharides) and Glycoprotein, Sulphuric acid is added to hydrolyzes the all glycosidic linkage to yield monosaccharides, which on dehydration form furfural or its derivative in presence of acid.which condened with α-naphthol to give a violet colored complex.

Oligosaccharide or poly saccharides + H_2SO_4 $\xrightarrow{H_3O^+ \text{ (Hydrolysis)}}$ Monosaccharides



D-glucose (monosaccharide) 5-(hydroxymethyl) furfural



5-(hydroxymethyl) furfural α-naphthol purple colored dye or violet colored complex

2. Barfoed Test

This test is used to differentiate reducing monosaccharide from a disaccharide sugar

It is done in mild acidic medium.

$RCHO + 2Cu^{2+} + 2H_2O \longrightarrow RCOOH + Cu_2O$ ppt $+ 4H^+$

It is based on the reduction of copper(II) acetate to copper(I) oxide (Cu_2O), which forms a brick-red precipitate.

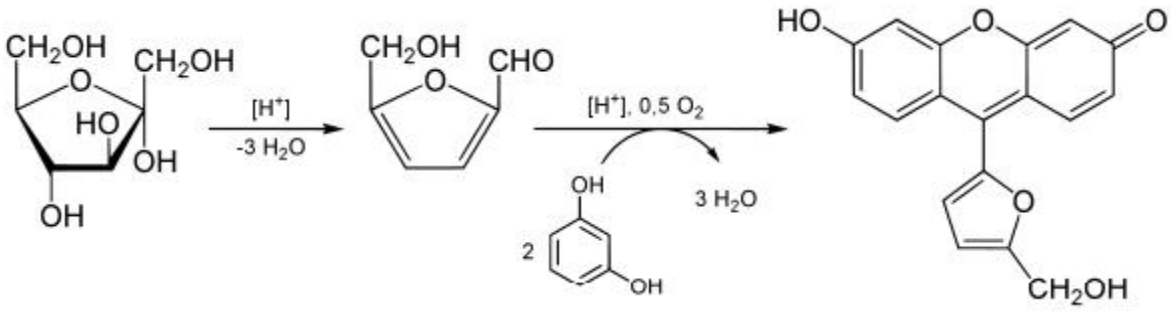
Reducing monosaccharides react with Barfoed's reagent much faster than disaccharides and produce red precipitate of copper (I) oxide within three minutes.

Disaccharide sugars as they are weaker reducing agents, react at a slower rate, so they do not form red precipitate even for ten minutes.

3. Selivanoff's Test

It is test of Ketose sugar (eg Fructose), it is used to differentiate Ketose sugar from aldose sugar.

This test relies on the principle that keto hexose are more rapidly dehydrated than aldoses to form 5-Hydroxy methyl furfural when heated in acidic medium, which on condensation with resorcinol, a cherry red (or Brown red) colored complex is formed rapidly indicating a positive test.



Fructose Resorcinol Cherry red ppt

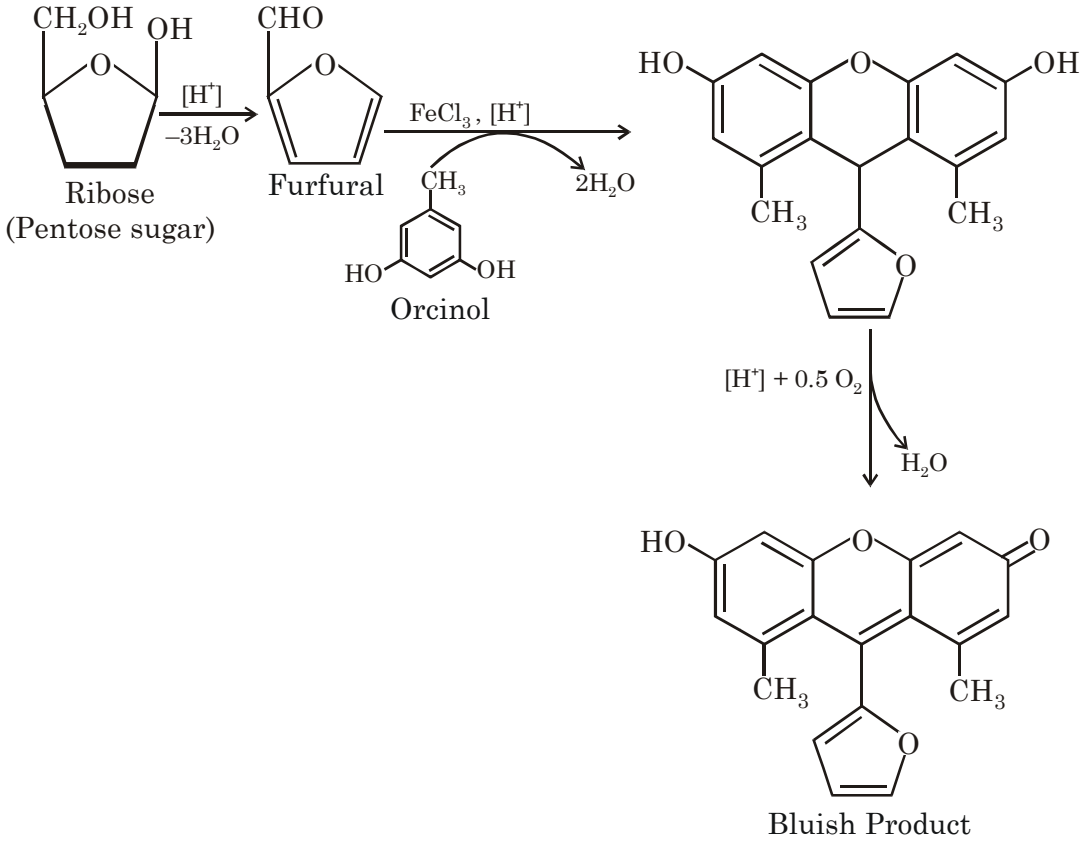
4. Bial's Test

Bial's test is positive for Pentoses

This test is used to differentiate Pentose and Hexose sugar

The test reagent dehydrates pentoses to form furfural. Furfural further reacts with Bial's reagent (a solution of orcinol, HCl and ferric chloride). orcinol and the iron ion present in the test reagent to produce a bluish product .

Figure insert



Ribose (Pentose sugar) Furfural Orcinol Bluish Product

Specifically Pentose sugar gives bluish colored complex.

All other colors indicate a negative result for pentoses.

Note: hexoses generally react to form green, red, or brown products.

5. Osazone Test

Reducing Sugars when heated with Phenyl Hydrazine,Characteristic yellow crystals of Osazone are formed with specific shape.

Glucose,Mannose & Fructose gives same Osazone crystals, like NEEDLE SHAPED.

Maltose gives Maltosazone crystals, like SUNFLOWER SHAPED.

Lactose gives lactosazone crystals,

like TIGHT BALL or POWDER PUFF SHAPED..

6. Benedict test

Carbohydrates which has Aldehyde functional group (Not Aromatic Aldehyde) or Having alpha hydroxy ketone gives positive Benedict Test

It is in mild Basic Medium.

$CuSO_4 \longrightarrow Cu^{++} + SO_4^{2-}$

$2Cu^{++}$ + Reducing Sugar $\longrightarrow Cu^{+}$

$Cu^{+} \longrightarrow Cu_2O$ ppt

Glucose (Blue Red Solution) ,,Galactose (Orange Red Solution)

Maltose (Dark Brown with Brick Red Solution),,Fructose (Dark Brown with Brick Red Solution)

Xylose (Brick Red solution)

7. Fehling's test

All reducing Carbohydrates give Positive Fehling's test with Fehling solution.Carbohydrates which has Aldehyde functional group (Not Aromatic Aldehyde) and alpha hydroxy carbonyl also gives positive Fehling's test (e.g. fuctose). While Ketones give negative fehling test. During this reaction the aldehyde group is oxidised to acid while the copper ions are reduced to red/brown precipitate of Cu_2O. This is a common test used to detect glucose in urine as positive indication of diabetes.

$CuSO_4 \longrightarrow Cu^{++} + SO_4^{2-}$

$2Cu^{++}$ + Reducing Sugar $\longrightarrow Cu_2O$ (Red / Brown ppt)

8. Tollen's test

This test is also given by reducing sugars. Carbohydrates reacts with Tollens reagent forms a silver mirror on the inner walls of the test tube. This confirms the presence of reducing sugars. Silver ions are reduced to metallic silver.

$$RCHO \xrightarrow[(ii)\,H^+]{(i)\,\left[Ag(NH_3)_2\right]OH} RCOOH + Ag \text{ (Silver mirror)}$$

Note : Sucrose , poly sachharides also others non reducing sugar do not give Benedict test , Fehling test and Tollen's Test.

9. Iodine Test

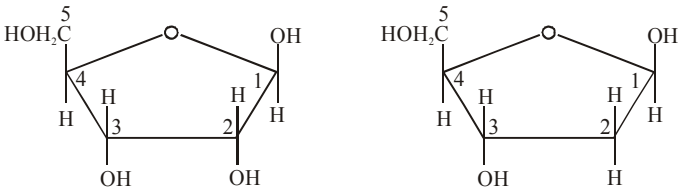
The iodine test is used to test for the presence of starch. Starch turns into an intense 'Deep blue' colour upon addition of aqueous solutions of the triodide anion.

NUCLEIC ACIDS

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**. These are mainly of two types, the **deoxyribonucleic acid (DNA) and ribonucleic acid (RNA)**. Since nucleic acids are long chain polymers of **nucleotides**, so they are also called polynucleotides.

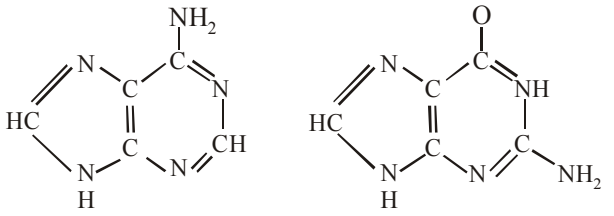
Chemical Composition of Nucleic Acids

Complete hydrolysis of DNA (or RNA) yields a pentose sugar, phosphoric acid and nitrogen containing heterocyclic compounds (called bases). In DNA molecules, the sugar moiety is b-D-2-deoxyribose whereas in RNA molecule, it is b-D-ribose.

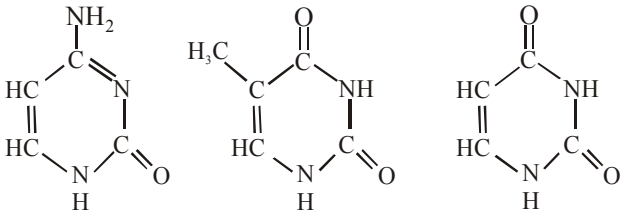


β–D–ribose β–D–2–deoxyribose

DNA contains four bases viz. adenine (A), guanine (G), cytosine (C) and thymine (T). RNA also contains four bases, the first three bases are same as in DNA but the fourth one is uracil (U).



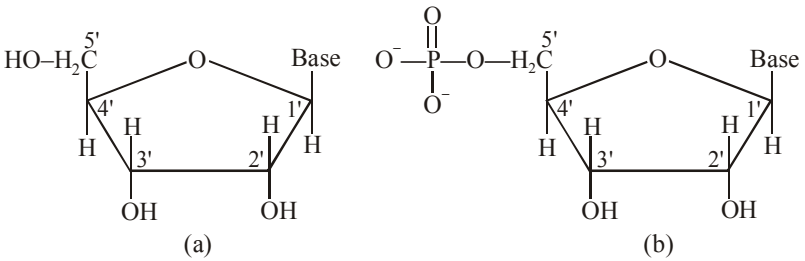
Adenine (A) Guanine (G)



Cytosine (C) Thymine (T) Uracil (U)

Structure of Nucleic Acids

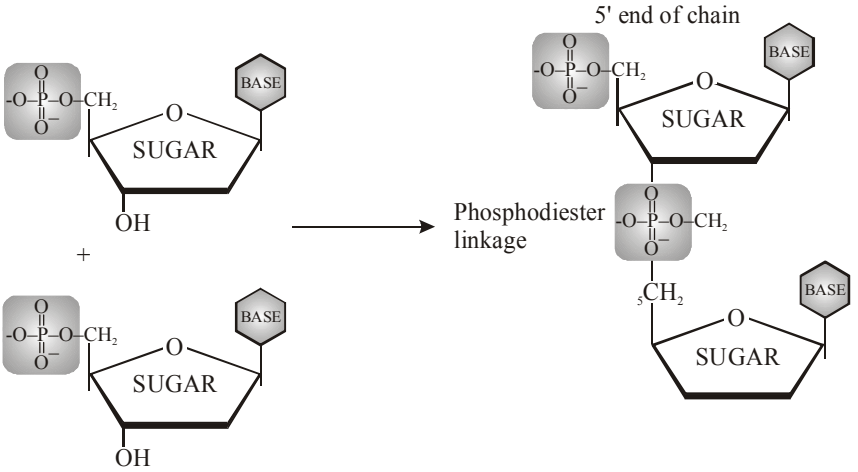
A unit formed by the attachment of a base to 1' position of sugar is of known as **nucleoside**. In nucleosides, the sugar carbons are numbered as 1', 2', 3', etc. in order to distinguish these from the bases. When nucleoside is linked to phosphoric acid at 5'-position of sugar moiety, we get a nucleotide



(a) (b)

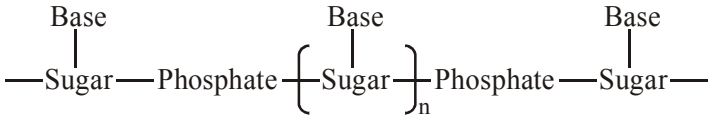
Structure of (a) a nucleoside and (b) a nucleotide

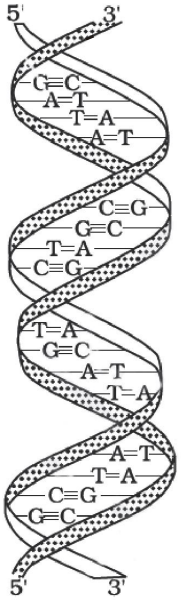
Nucleotides are joined together by phosphodiester linkage between 5' and 3' carbon atoms of the pentose sugar. The formation of a typical dinucleotide is shown in Fig.



Formation of dinucleotide

A simplified version of nucleic acid chain is as shown below.





Information regarding the sequence of nucleotides in the chain of a nucleic acid is called its primary structure. Nucleic acids have a secondary structure also. James Watson and Francis Crick gav, a double strand helix structure for DNA (Fig. 14.7). Two nucleic acid chains are wound about each other and held together by hydrogen bonds between pairs of bases. The two strands are complementary to each other because the hydrogen bonds are formed between specific pairs of bases. Adenine forms hydrogen bonds with thymine whereas cytosine forms hydrogen bonds with guanine.

In secondary structure of RNA, helices are present which are only single stranded. Sometimes they fold back on themselves to form a double helix structure. RNA molecules are of three types and they perform different functions. They are named as **messenger RNA (m-RNA), ribosomal RNA (r-RNA) and transfer RNA (t-RNA)**.

Fig. : Double strand helix structure for DNA

Photosynthesis

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sun light}} C_6H_{12}O_6 + 6CO_2$$

* 3ATP are required to fix 1 mole of CO_2. Therefore 18 ATP are required to fix 6 mole of CO_2.

Cellular Respiration

$$C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{Enzymes}} 6CO_2 + 6H_2O + 38\ ATP$$

* 38 ATP are generated by complete oxidation of 1 mole of glucose. But net gain of ATP are 36, because 2 ATP are consumed when pyruvic acid enter in mitochondria.

* Complete oxidation takes place in two steps

Step - 1 : Glycolysis or EMP or HMP (Completes in cytoplasm)

$$C_6H_{12}O_6 \xrightarrow[2NADP \quad 2NADPH_2]{\text{Enzymes}} 2\ CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-OH\ +\ 8\ ATP$$

Pyruvic acid

Step - 2 : Kreb cycle (Completes in mitochondria)

$$2\ CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-OH\ +6O_2 \xrightarrow{\text{Enzymes}} 6CO_2\ +\ 6H_2O + 30\ ATP$$

Pyruvic acid

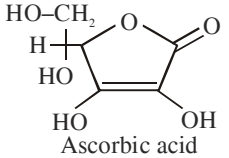
VITAMINES

Table : Some important Vitamins, their Sources and their Deficiency Diseases

Sl. No.	*Name of Vitamins*	*Sources*	*Deficiency diseases*
1	Vitamin A	Fish liver oil, carrots, butter and milk	Xerophthamlia (hardening of cornea of eye) Night blindness
2	Vitamin B_1 (Thiamine)	Yeast, milk, green vegetables and cereals	Beri beri (loss of appetite, retarded growth)
3	Vitamin B_3 (Riboflavin)	Milk, eggwhite, liver, kidney	Cheilosis (fissuring at corners of mouth and lips), digestive disorders and burning sensation of the skin.
4	Vitamin B_3 (Pyridoxine)	Yeast, milk, egg yolk, cereals and grams	Convulsions
5	Vitamin B_{12}	Meat, fish, egg and curd	Pernicious anaemia (RBC deficient in haemoglobin)
6	Vitamin B_5 (Ascorbic acid)	Citrus fruits, amla and green leafy vegetables	Scurvy (bleeding gums)
7	Vitamin D	Exposure to sunlight, fish and egg yolk	Rickets (bone deformities in children) and osteomalacia (soft bones and joint pain in adults)
8	Vitamin E	Vegatable oils like wheat germ oil, sunflower oil, etc.	Increased fragility of RBCs and muscular weakness
9	Vitamin K	Green leafy vegetables	Increased blood clotting time

NOTE : Vitamin-D , E , K , A are fat soluble vitamins.

Vitamin-B , C are water soluble vitamins.



Ascorbic acid
(Vitamin-C)

EXERCISE # O-I

1 Iso-electric point of alanine is (pH = 6). At which pH, maximum concentration of zwitter ion of alanine will be present ?

(A) pH > 6 (B) pH < 6 (C) pH = 6 (D) pH = 7

BM0001

2 At iso-electric point :

(A) Concentration of cation is equal to concentration of anion

(B) Net charge is zero

(C) Maximum conc. of di-pole ion (Zwitter ion) will be present

(D) All of the above

BM0002

3 Which of following amino acid has lowest iso-electric point ?

(A) Glycine (B) Alanine (C) Aspartic acid (D) Lysine

BM0003

4 $H—C \equiv C—H \xrightarrow[H_2SO_4]{HgSO_4} (A) \xrightarrow[(2)\ H_3O^+]{(1)\ NH_3+HCN} (B)$; Product (B) of given reaction is :

(A) Glycine (B) Alanine (C) Valine (D) Leucine

BM0004

5 Which amino acid does not contain chiral centre ?

(A) Valine (B) Leucine (C) Glycine (D) Iso-leucine

BM0005

6 Which of the following is Sanger reagent ?

(A) 2,4-Di-nitro flurobenzene (B) Phenyl isocyanane

(C) 2,4-Di-nitro chlororbenzene (D) 12,4-Di-nitro-iodobenzene

BM0006

7 A D-carbohydrate is :

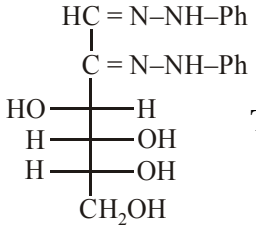
(A) Always dextrorotatory

(B) Always laevorotatrory

(C) Always the mirror of the corresponding L-carbohydrate

(D) None of these

BM0007

8 

The given osazone can be obtained by :

(A) D-glucose (B) D-mannose (C) D-Idose (D) Both (A) & (B)

BM0008

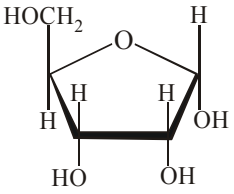
9 Which of the following pair gives same phenyl osazone ?

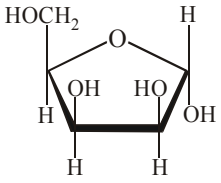
(A) D-Glucose and D-Allose (B) D-Glucose and D-Altrose

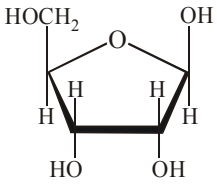
(C) D-Glucose and D-Mannose (D) D-Glucose and D-Talose

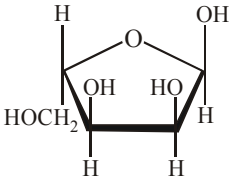
BM0009

10 Which of the following represents the anomer of the compound shown ?



(A) 

(B) 

(C) 

(D) None of these

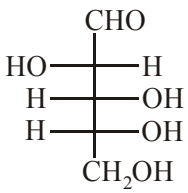
BM0010

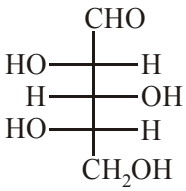
11 For the complex conversion of D-glucose into the corresponding osazone, the minimum number of equivalents of phenyl hydrzine required is :

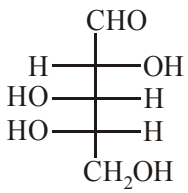
(A) Two (B) Three (C) Four (D) Five

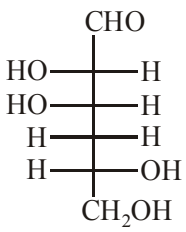
BM0011

12 Which of the following structure is L-arabinose ?

(A) 

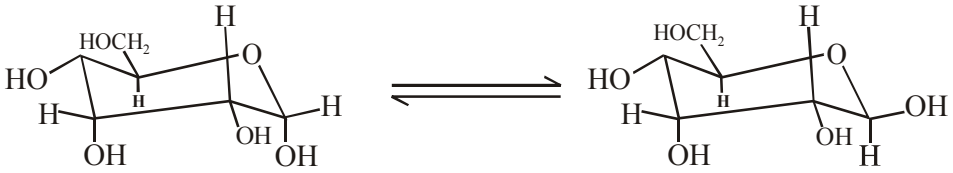
(B) 

(C) 

(D) 

BM0012

13 Which one of the statements concerning the equilibrium shown is true ?



(A) The two structures are enantiomers of each other. They have equal but oppostie optical rotations and recemize slowly at room temperature

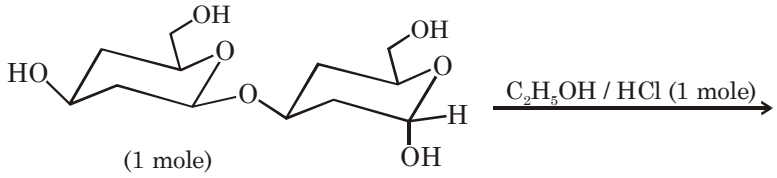
(B) The two structures are enantiomers of each other. They racemize too rapidly at room temperature for their optical rotations to be measured

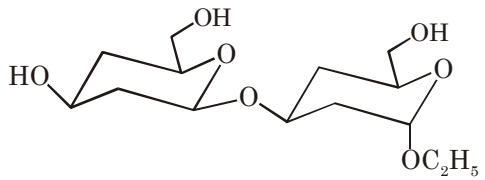
(C) The two structures are diastereomers of each other. Their interconversion is called mutarotation

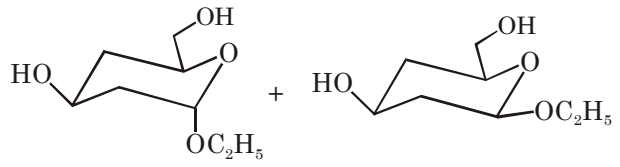
(D) The two structures are diastereomers of each other. Their interconversion does not require breaking and making bonds, only a change in conformation

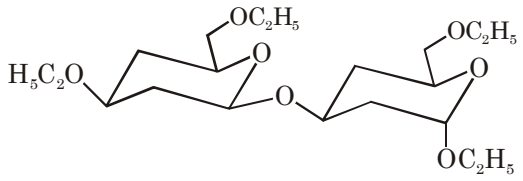
BM0013

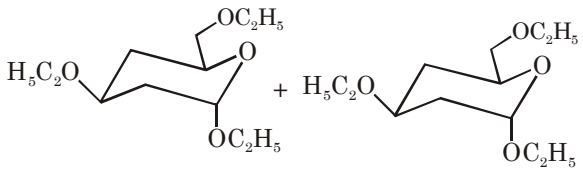
14 Major product of following reaction is :



(A) 

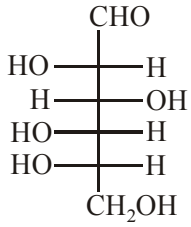
(B) 

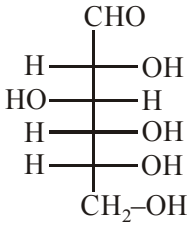
(C) 

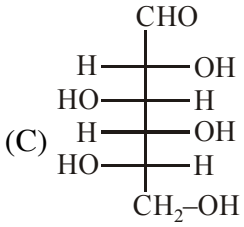
(D) 

BM0014

15 What is the structure of L-glucose ?

(A) 

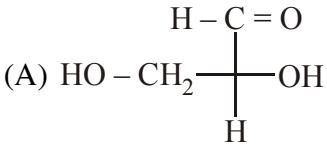
(B) 

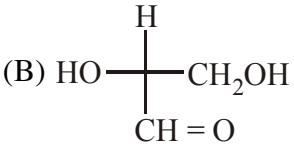
(C) 

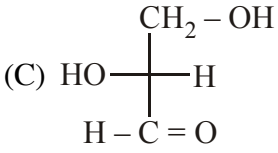
(D) None of these

BM0015

16 What is the structure of L-glyceraldehyde ?

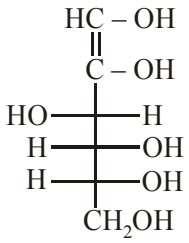
(A) 

(B) 

(C) 

(D) Both (A) and (B)

BM0016

17  , the given is enol form of :

(A) D-glucose (B) D-mannose (C) D-fructose (D) All of these

BM0017

18 D-glucose & D-fructose can be differentiated by :

(A) Fehling solution (B) Tollen's reagent (C) Benedict test (D) Br_2 / H_2O

BM0018

19 D-Glucose exist in x different forms. The value of x (stereoisomer) is :

(A) 2 (B) 3 (C) 4 (D) 5

BM0019

20 D-Mannose $\underset{}{\overset{HO^-}{\rightleftharpoons}}$ D-Glucose $\underset{}{\overset{HO^-}{\rightleftharpoons}}$ (A) ;

Product (A) of above reaction is :

(A) D-glucose (B) D-fructose (C) D-talose (D) D-idose

BM0020

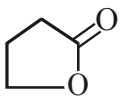
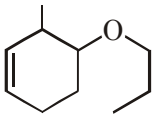
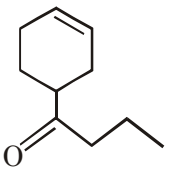
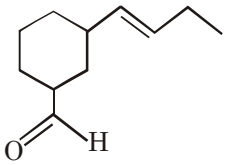
21 Which of the following statement is not correct for maltose.

(A) It is a disaccharide (B) It undergoes mutarotation

(C) It is a reducing sugar (D) It does not have hemiacetal group.

BM0021

22 A compound which does not react with Brady's reagent but decolourise Br_2 / H_2O solution is :

(A)  (B)  (C)  (D) 

BM0022

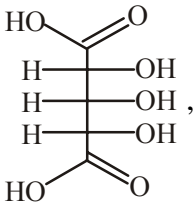
23 Maltose is made up of to two sugars–

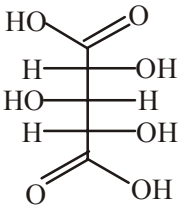
(A) Glucose (B) Fructose

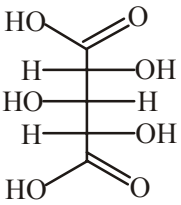
(C) Glucose & galactose (D) Glucose & fructose

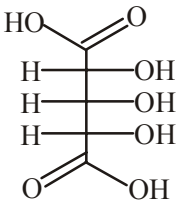
BM0023

24 D-Ribose when treated with dilute HNO_3 forms.

(A)  , Achiral

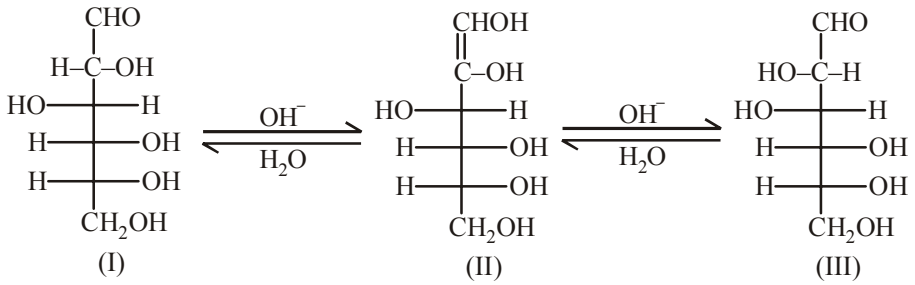
(B)  , Chiral

(C)  , Achiral

(D)  , Chiral

BM0024

25 Consider the given process



(I) (II) (III)

and identify the incorrect statement.

(A) Configuration at C–2 is lost on enolisation

(B) I and III are epimers

(C) Proton transfer from water to C–1 converts ene diol to an aldose.

(D) D-glucose can isomerise to D-fructose through enol intermediate.

BM0025

26 When methyl D-glucopyranoside is treated with HIO_4 its number of mole consumed per mole of the sugare is -

(A) 2 (B) 3 (C) 4 (D) 5

BM0026

27 α - amino acid when heated with NaOH/CaO forms -

(A) α,β - unsaturated acid (B) α,β - unsaturated amine

(C) Carboxylic acid (D) Amine

BM0027

28 The configuration of the C-2 epimer of D-glucose is-

(A) 2R, 3S, 4R, 5S (B) 2S, 3S, 4R, 5R

(C) 2S, 3R, 4S, 5R (D) 2R, 3S, 4R, 5R

BM0028

29 Mutarotation involve-

(A) Racemisation (B) Diastereomerisation

(C) Optical resolution (D) Conformational inversion

BM0029

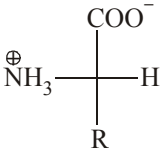
30 Consider the reaction sequence -

$$\text{Glucose} \xrightarrow[\text{excess}]{PhNHNH_2} P \xrightarrow[\Delta]{H_3O^+} Q \xrightarrow[AcOH]{Zn} R$$

The product R is -

(A) Arbinose (B) Sorbitol (C) Fructose (D) Mannose

BM0030

31 The pH of the solution containing following zwitter ion species is 

(A) 4 (B) 5 (C) 7 (D) 9

BM0031

32 Peptide linkage is -

(A) $-\overset{\overset{O}{\|}}{C}-O-$ (B) $-\overset{\overset{O}{\|}}{C}-NH_2$ (C) $-\overset{\overset{O}{\|}}{C}-NH-$ (D) $-\overset{\overset{O}{\|}}{C}-NH-NH_2$

BM0032

33 Same osazone derivative is obtained in case of D-glucose, D-Mannose and D-Fructose due to

(A) The same configuration at C-5

(B) The same constitution.

(C) The same constitution at C-1 and C-2

(D) The same constitution and acid configuration at C-3, C-4, C-5 and C-6 but different constitution and configuration at C-1 and C-2 which becomes identical by osazone formation.

BM0033

34 $D(-)-Erythrose \xrightarrow{NaBH_4} (P)$

$D(-)-Threose \xrightarrow{NaBH_4} (R)$

Which of the following statement is correct about P and R ?

(A) Both are optically active (B) Both are optically inactive

(C) P is optically inactive and R is optically active (D) Neither P nor R has asymmetric carbon.

BM0034

35 The monomer of nucleic acids are held together by

(A) Phosphodiester linkage (B) Amide linkage

(C) Glycosidic linkage (D) Ester linkage

BM0035

36 Select the incorrect statement about Nylon 2-nylon-6.

(A) It is a copolymer

(B) It is biodegradable

(C) It is an alternating polyamide

(D) It is made up of $CH_3-\underset{\underset{NH_2}{|}}{CH}-COOH$ and $H_2N(CH_2)_5COOH$

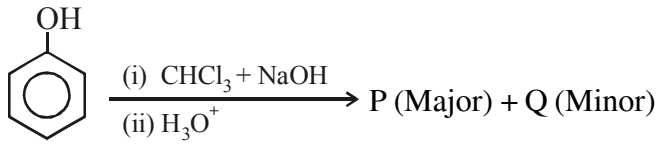
BM0036

37 The monomer that can undergo radical, cationic and anionic polymerisation with equal case-

(A) $Me-\underset{\underset{Me}{|}}{C}=CH_2$ (B) $Ph-CH=CH_2$ (C) $CH_2=CH_2$ (D) $CH_2=CH-CN$

BM0037

38 Consider the reaction-



Mixture of A and B can be best separated by -

(A) Steam distillation (B) Vacuum distillation

(C) Fractional distillation (D) Crystallisation

BM0038

39 Which of the following statements are incorrect :

(A) Copolymer of 1,3-butandiene & acrylonitrile is Buna-S

(B) HDPE is obtained by Ziegler-Natta polymerisation

(C) Polymer dacron can be polyester fabric

(D) Phenol & formaldehyde resin is called novolac

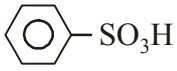
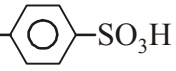
BM0039

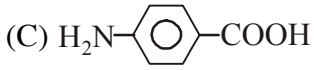
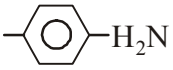
40 A segment (X) of cellulose obtained on partial hydrolysis has molecular mass 1476 gm. On complete acidic hydrolysis, mass of the product obtained is 1620 gm. Find out the number of glycosidic linkage(s) present in segment (X) :

(A) 8 (B) 6 (C) 4 (D) 10

BM0040

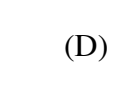
41 When solidum extract is treated with $FeCl_3$ solution a blood red coloured is obtained due to the presence of -

(A)  (B) 

(C)  (D) 

BM0041

42 The monomer that undergo radical polymerisation most easily is

(A) $CH_2=CH_2$ (B) $C_6H_5CH=CH_2$ (C)  (D) $CH_3–CH=CH_2$

BM0042

EXERCISE # O-II

1 Carbohydrates may be :

(A) Sugars

(B) Starch

(C) Polyhydroxy aldehyde/ ketones

(D) Compounds that can be hydrolysed to sugar

BM0043

2 Select the correct statement :

(A) Glycosides do not undergo mutarotation

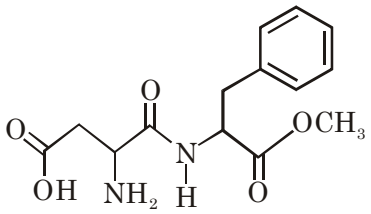
(B) All OH groups of a cyclic monosaccharides are converted to ethers by treatment with base and an alkyl halide

(C) α-D glucose reacts with Ag_2O and excess CH_3I to form tetramethyl ether

(D) D-glucose upon treatment with warm HNO_3 forms D-glucaric acid

BM0044

3 "Aspartame" is roughly 100 times as sweet as cane sugar. On complete hydrolysis of aspartame, products obtained is/are :



(A) $PhCH_2–\underset{\displaystyle CO_2H}{\underset{|}{CH}}–NH_2$ (B) $H_2N–\underset{\displaystyle CH_2CO_2H}{\underset{|}{CH}}–CO_2H$ (C) CH_3OH (D) $CH_3–\underset{\displaystyle CO_2H}{\underset{|}{CH}}–NH_2$

BM0045

4 Starch molecules are polymer with repeating glucose units. Select the correct statement(s).

(A) Glucose units are joined through α-glycosidic linkage

(B) The branches of amylopectin are linked to the chain with α-1,6'-glycosidic linkages

(C) The linear linkages of amylopectin are formed by α-1,6'-glycosidic bond

(D) Amylose has an unbranched skeleton of glucose molecules with α-1,4'-glycosidic linkages

BM0046

5 Select the correct option.

(A) Isoelectric point is the pH at which an amino acid exists primarily in its neutral form.

(B) Isoelectric point is the average of pK_a values of α-COOH amino α- NH_3^+ groups [valid only for neutral amino acid]

(C) Glycine is characterised by two pK_a values

(D) For neutral amino acid the concentration of zwitter ion is maximum at its isoelectric point

BM0047

6 Amino acids are synthesised from

(A) α-Halo acids by reaction with NH_3

(B) Aldehydes by reaction with NH_3 and cyanide ion followed by hydrolysis

(C) Pyruvic acid is treated with NH_3 followed by addition of H_2(Ni)

(D) Alcohols by reaction with NH_3 and CN^- ion followed by hydroysis.

BM0048

7 Which of the following carbohydrates developes blue colour on treatment with iodine solution ?

(A) Glucose (B) Amylose (C) Starch (D) Fructose

BM0049

8 Select the **correct** statement

(A) High density polythene is a linear polymer.

(B) Low density polythene is a branched chain polymer.

(C) Chain growth polymers are also known as addition polymer.

(D) Step growth polymer is also known condensation polymer.

BM0050

9 Select the correct statement.

(A) Elastomers have the weakest intermolecular forces

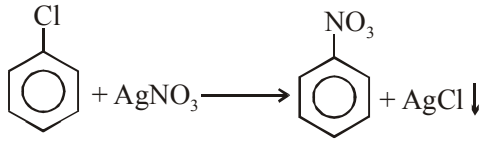
(B) Buna-N is example of synthetic copolymer

(C) Some fibres have crystalline nature

(D) Thermoplastic polymers have stronger intermolecular forces than fibres

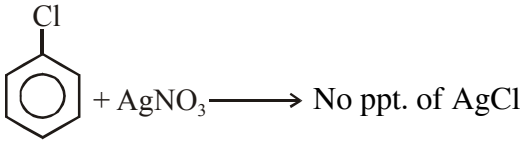
BM0051

10 Which of the following options are correct :

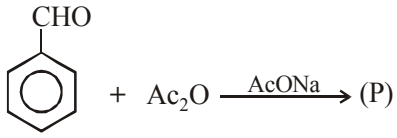
(A) 

(B) Na extract of sample containing chlorobenzene $\xrightarrow{+ AgNO_3}$ white ppt. of AgCl

(C) Na extract of sample containing chlorobenzene $\xrightarrow{+ AgNO_3}$ No ppt. of AgCl

(D) 

BM0052

11 

Before isolating (P) unreacted Ph–CHO is removed first. Select the correct statement.

(A) P is cinnamaldehyde (B) P is crotonic acid

(C) Removal is done by simple distillation (D) P is cinnamic acid.

BM0053

12 If on a strand of DNA the base sequence is ATTGACGCAT then the sequence transcription on RNA would be -

(A)UAACUGCGUA (B) AUUCUGCGUA

(C) UAACTGCGUA (D) TAACTGCGTA

BM0054

13 Select the correct statement among following

(A) Number of chiral atom in α-D-glucose is less than D-glucose

(B) D-glucose and D-fructose give same product with HIO_4

(C) D-glucose and D-fructose give same product with H_2NOH

(D) D-glucose and D-fructose form same product with $H_2N–NH–Ph$

BM0055

14 The N-base which differenciate DNA with RNA is :

(A) Cytosine (B) Uracil (C) Adenine (D) Guanine

BM0056

15 Correct statement

(A) Nylon-66 is example of addition polymer

(B) Alanin having pH 9 at isoelectric point

(C) Fructose when reacts with fehling solution reddish brown ppt. formed

(D) All of these

BM0057

16 Match the column :

Column I	**Column II**
(A) Sucrose	(P) Two acetals
(B) Maltose	(Q) No hemiacetal
(C) Lactose	(R) β–1,4'-glycosidic bond
(D) Cellulose	(S) One of the hydrolysis product is glucose

BM0058

17 Match the column

Column I **(Component of mixture)**	**Column II** **(Reagent)**
(A) Crystalline Na_2CO_3 + Sodium citrate + $CuSO_4$(aq. sol.)	(P) Fehling solution
(B) $CuSO_4$ + Rochelle Salt + NaOH(Aq. sol.)	(Q) Nesseler's Reagent
(C) 10% α - naphthol in alcohol	(R) Bennedict's solution
(D) HgCl + KI + KOH (aq. sol.)	(S) Molisch's Reagent

BM0059

EXERCISE # S-I

Assertion Reason

1 **Statement 1 :** Furanose ring, like pyranose rings are not planar.
Statement 2 : The most stable conformation of furanose is envelope form.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

BM0060

2 **Statement 1 :** Bromine water changes glucose to gluconic acid.
Statement 2 : Bromine water acts as oxidising agent.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

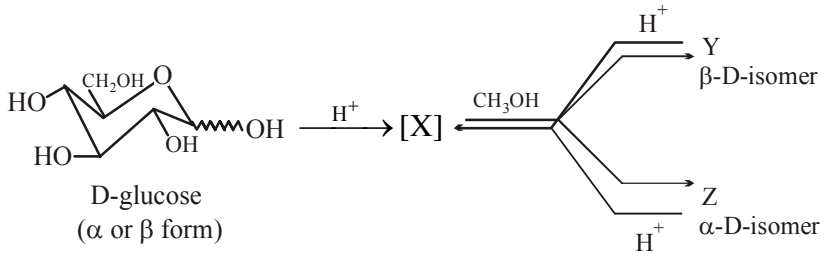
BM0061

3 **Statement 1 :** All monosaccharide ketoses are reducing sugars.
Statement 2 : Monosaccharide ketose give positive Tollen's and Fehling's test.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

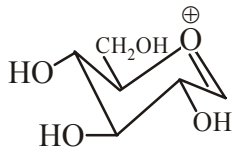
BM0062

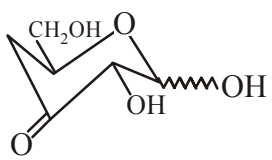
Comprehension (Q.4 to Q.6)

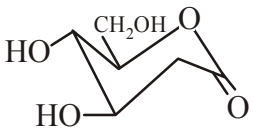
Consider the following reversible process for a reaction of D-glucose.

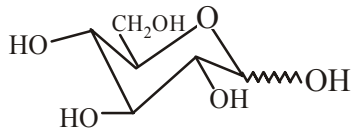


4 The structure of intermediate [X] is

(A) 

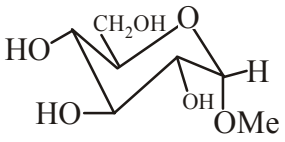
(B) 

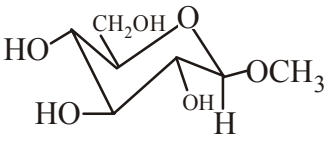
(C) 

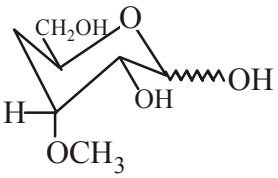
(D) 

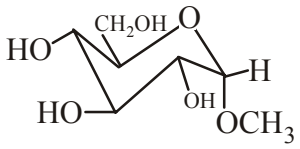
BM0063

5 Select the correct option.

(A) Y is 

(B) Z is 

(C) Y is 

(D) Z is 

BM0064

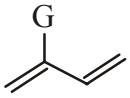
6 Select the correct statement.

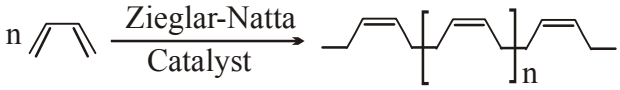
(A) Y is more stable than Z due to H-bond (B) Y is less stable than Z due to anomeric effect.

(C) Y is more stable than Z due to anomeric effect (D) Y is less stable than Z due to H-bond.

BM0065

Comprehension (Q.7 to Q.9)

The monomer  (G = Me or Cl) when treated with Zieglar - Natta catalyst undergo polymerisation in the manner given below -



cis-poly-1,3-butadiene

7 The Zieglar-Natta catalyst is

(A) $TiCl_4$ (B) R_3Al (C) R_3 Al / $TiCl_4$ (D) R_3 B/$TiCl_4$

BM0066

8 The polymer obtained when monomeric unit used is $CH_2=\overset{\overset{Cl}{|}}{C}-CH=CH_2$

(A) Neoprene (B) Stilbene (C) Styrene (D) Chloropicrin

BM0067

9 Which of the following statement is not true considering the process given above.

(A) The general class of polymer formed is known as homopolymer

(B) The polymer obtained is stereoregular

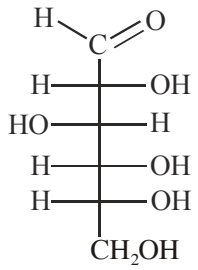
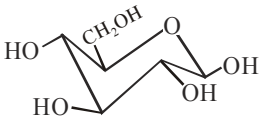
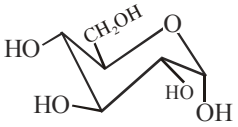
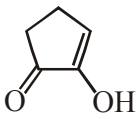
(C) Buna–N can be prepared using above process

(D) Synthetic rubber can be formed by above process using 1,3- butadiene.

BM0068

Match the Column

10 Match the compounds given below existing in equilbrium mixture with their percentage given in the right hand side.

Column I	**Column II**
(A) 	(P) 36 %
(B) 	(Q) 63.8 %
(C) 	(R) 99.9 %
(D) 	(S) 0.2 %

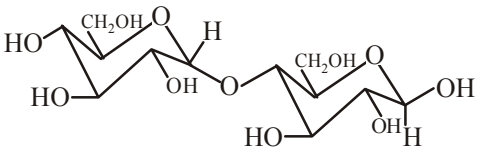
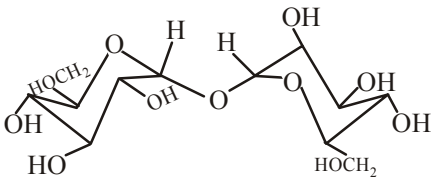
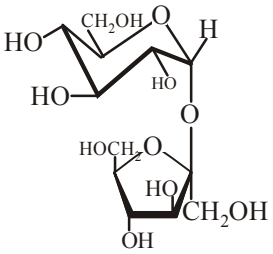
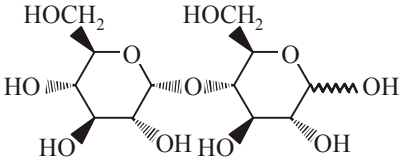
BM0069

11 Match the column :

Column I **(Carbohydrate)**	**Column II** **(Properties)**
(A) Starch	(P) Mutarotation
(B) Sucrose	(Q) Non reducing sugar
(C) Lactose	(R) β-glycosidic bond
(D) Maltose	(S) α-glycosidic bond
	(T) Reducing sugar
	(U) Hemiacetal

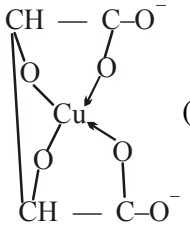
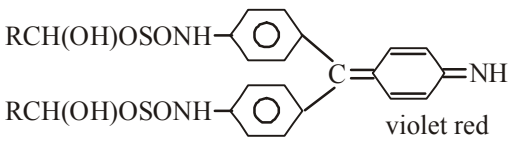
BM0070

12 Match the column :

Column I	**Column II**
(A) 	(P) α-glycoside bonds
(B) 	(Q) Reducing sugar
(C) 	(R) Forms enediol intermediate
(D) 	(S) β-glycoside bond

BM0071

13 Match the column

Column I **(Functional group)**	**Column II** **(Test used or complex formed during confirmatory test)**
(A) Aldehydic	(P) $[(C_6H_5O)_6Fe]^{-3}$ (violet)
(B) Phenolic	(Q)  (blue)
(C) Alcohol	(R)  violet red
(D) α-D- Glucopyranose	(S) $(ROH)_2Ce(NO_3)_4$ (Red)
	(T) Molisch's Test

BM0072

14 Match the column :

Column I	**Column II**
(A) Addition polymer	(P) Buna-S
(B) Condensation polymer	(Q) Buna-N
(C) Homopolymer	(R) Polythene
(D) Copolymers	(S) Nylon 6,6

BM0073

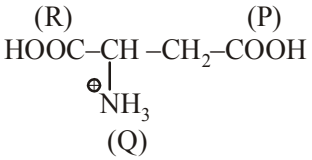
15 Match the column

Presence of the element in Na - extract	**Complex formed in one of the test**	**Colour of the complex**
(A) N	(P) $Na_4[Fe(CN)_5NOS]$	(W) Prussian Blue
(B) S	(Q) $Fe(CNS)_3$	(X) Black
(C) N and S together	(R) PbS	(Y) Violet
	(S) $Fe_4[Fe(CN)_6]$	(Z) Blood Red

BM0074

Subjective Type :

16 The pKa values for the three acidic group P,Q,R are 4.3, 9.7 and 2.2 respectively



Calculate the isoelectric point of the amino acid ?

BM0075

17 How will you separate?

(a) Ethane & Ethyne

BM0076

(b) 1-Butyne & 2-Butyne

BM0077

(c) Phenol & Propanol

BM0078

(d) 2-Propanol & Propanone

BM0079

(e) CH_3COOH & $HCOOCH_3$

BM0080

(f) PhOH & PhCOOH

BM0081

(g) C_2H_4 & C_2H_2

BM0082

(h) $EtNH_2$ & Me_2NH

BM0083

(i) EtOH & Et – O – Et

BM0084

18 How will you differentiate?

(a) Propane & Propene

BM0085

(b) 1,1-Dichloroethane & 1,2-Dichloroethane

BM0086

(c) Chloroethane & Chloroethene

BM0087

(d) Pure & Oxidized $CHCl_3$

BM0088

(e) p-chlorotoluene & benzylchloride

BM0089

(f) n-propylchloride & isopropylchloride

BM0090

(g) Methanol & ethanol

BM0091

(h) Isobutanol & tert-butanol

BM0092

(i) 2-Pentanol & 3-pentanol

BM0093

(j) O-cresol & benzylalcohol

BM0094

(k) Ethanol & Propanol

BM0095

(l) Propanone & Ethanol

BM0096

(m) HCHO & PhCHO

BM0097

(n) Glucose & Fructose

BM0098

(o) HCOOH & CH_3COOH

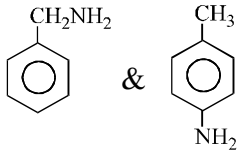
BM0099

(p) HCOOH & HCHO

BM0100

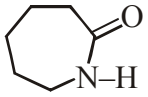
(q) $MeNH_2$ & Me_2NH

BM0101

(r) 

BM0102

19 (a) What is the structure of nylon-6, made by alkaline polymerisation of caprolactum.



BM0103

(b) Suggest mechanism for the process. Is polymerisation of the chain reaction or step reaction type.

BM0103

20 Compound (A) $C_5H_{10}O_5$ give a tetra-acetate with Ac_2O & oxidation of A with Br_2/H_2O gives an acid $C_5H_{10}O_6$. Reduction of A with HI & Red P. Give 2-methyl butane. What is structure of 'A'

BM0104

21 (i) Sulphanilic acid although has acidic as well as basic group. It is soluble in alkali but insoluble in mineral acid. Explain.

(ii) Explain why sulphonic acid is not soluble in organic solvents.

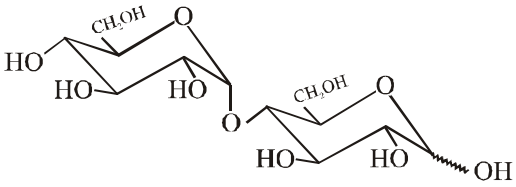
BM0105

22 Account for the fact that 2-amino ethanoic acid (glucine) exist as a dipolar ion as does p-aminobenzene sulphonic acid but p-amino benzoic acid does not.

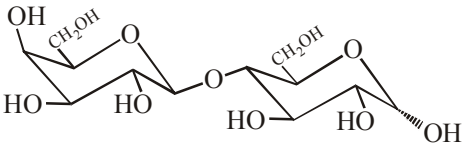
BM0106

23 For given compound

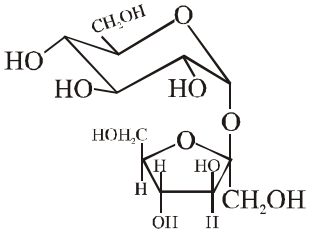
(i)



(ii)



(iii)



(a) Which glycosidic linkage is present

(b) Name of the compound

(c) Products obtained on hydrolysis

(d) Is it reducing sugar

(e) Number of moles of HIO_4 consumed

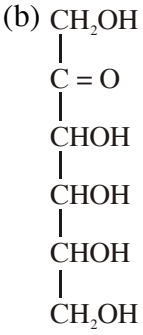
(f) Is mutarotation possible

(g) Number of moles of CH_3COCl consumed per mole of compound.

BM0107

24 For given compound

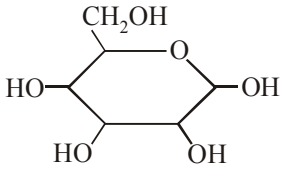
(a) 

(b) 

(i) Number of possible isomers
(ii) Number of possible D-configuration isomers
(iii) Number of possible L-configuration isomers

BM0108

25 Number of possible isomers of α-D-gluco pyronose configuration.



BM0109

26 Calculate isoelectric point of following amino acid

	pKa_1 (α-COOH)	pKa_2 (α-COOH)	pKa (side chain)
(a) Glycine $\overset{\oplus}{N}H_3 - CH_2 - COOH$	2.3	9.6	—
(b) Serine $CH_2(OH) - CH(\overset{\oplus}{N}H_3) - COOH$	2.2	9.2	—
(c) Alanive $CH_3 - CH(\overset{\oplus}{N}H_3) - COOH$	2.3	9.7	—
(d) Asparric acid $HOOC - CH_2 - CH(\overset{\oplus}{N}H_3) - COOH$	2.1	9.8	3.9
(e) Lysine $\overset{\oplus}{N}H_3–CH_2–CH_2–CH_2–CH_2–CH(\overset{\oplus}{N}H_3)–COOH$	2.2	9.0	10.5

BM0110

EXERCISE # J-MAIN

1. Which of the following pairs give positive Tollen's test? **[J-Main-2004]**

(1) Glucose, sucrose (2) Glucose, fructose

(3) Hexanal, Acetophenone (4) Fructose, sucrose

BM0111

2. Two forms of D – glucopyranose, are called. **[J-Main-2005]**

(1) Enantiomers (2) Anomers (3) Epimers (4) Diastereomers

BM0112

3. When benzene sulfonic acid and p-nitrophenol are treated with $NaHCO_3$, the gases released respectively are **[J-Main-2006]**

(1) SO_2, NO_2 (2) SO_2, NO (3) SO_2, CO_2 (4) CO_2, CO_2

BM0113

4. **Statement-1 :** Glucose gives a reddish-brown precipitate with Fehling's solution.

because **[J-Main-2007]**

Statement-2 : Reaction of glucose with Fehling's solution gives CuO and gluconic acid.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(3) Statement-1 is True, Statement-2 is False.

(4) Statement-1 is False, Statement-2 is True.

BM0114

5. Which one of the following bases is **not present** in DNA ? **[J-Main-2014]**

(1) Cytosine (2) Thymine (3) Quinoline (4) Adenine

BM0115

6. Which one is classified as a condensation polymer? **[J-Main- 2014]**

(1) Teflon (2) Acrylonitrile (3) Dacron (4) Neoprene

BM0116

7. Which of the vitamins given below is water soluble? **[J-Main- 2015]**

(1) Vitamin E (2) Vitamin K (3) Vitamin C (4) Vitamin D

BM0117

8. Thiol group is present in : **[J-Main-2016]**

(1) Methionine (2) Cytosine (3) Cystine (4) Cysteine

BM0118

9. The distillation technique most suited for separating glycerol from spent-lye in the soap industry is **[J-Main-2016]**

(1) Distillation under reduced pressure

(2) Simple distillation

(3) Fractional distillation

(4) Steam distillation

BM0119

10. Which of the following statements about low density polythene is FALSE ? **[J-Main-2016]**

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

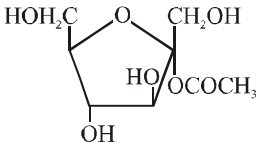
(2) Its synthesis requires high pressure

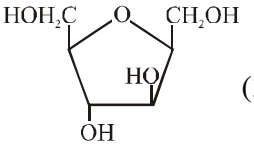
(3) It is a poor conductor of electricity

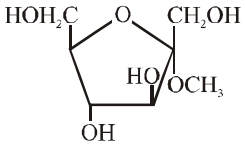
(4) Its synthesis requires dioxygen or a peroxide initiator as a catalyst.

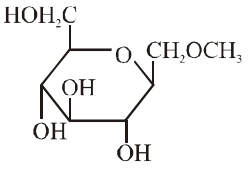
BM0120

11. Which of the following compounds will behave as a reducing sugar in an aqueous KOH solution **[J-Main-2017]**

(1) 

(2) 

(3) 

(4) 

BM0121

12. The formation of which of the following polymers involves hydrolysis reaction ? **[J-Main-2017]**

(1) Nylon 6 (2) Bakelite (3) Nylon 6, 6 (4) Terylene

BM0122

13. Glucose on prolonged heating with HI gives : **[J-Main-2018]**

(1) 1–Hexene (2) Hexanoic acid (3) 6-iodohexanal (4) n-Hexane

BM0123

14. Which of the following statement is not true :- **[J-Main-2018]**

(1) Nylon 6 is an example of step-growth polymerisation

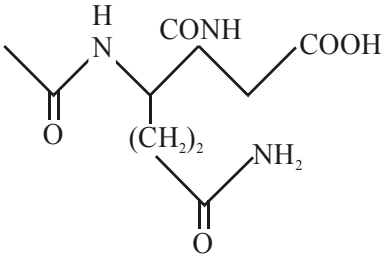
(2) Chain growth polymerisation involves homopolymerisation only

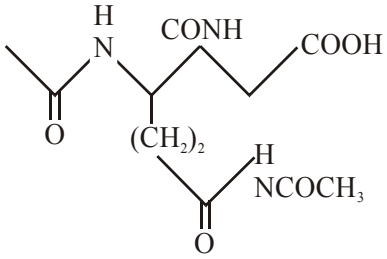
(3) Step growth polymerisation requires a bifunctional monomer

(4) Chain growth polymerisation includes both homopolymerisation and copolymerisation

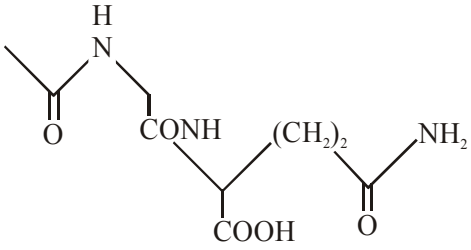
BM0124

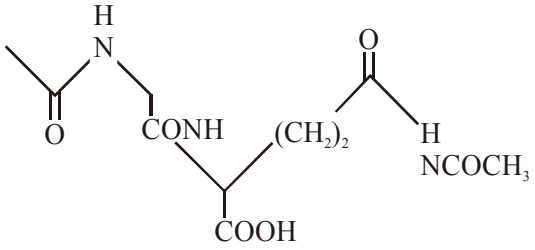
15. The dipeptide, Gln-Gly, on treatment with CH_3COCl_3 followed by aqueous work work up gives :-

(1) 

(2) 

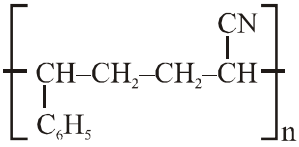
[J-Main-2018]

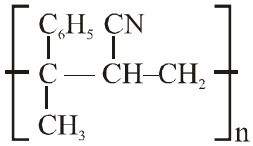
(3) 

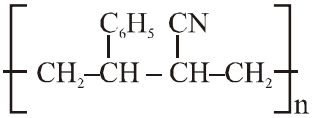
(4) 

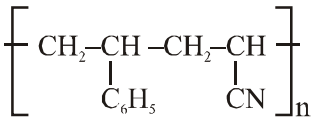
BM0125

16. The copolymer formed by addition polymerization of styrene and acrylonitrile in the presence of peroxide is : **[J-Main-2018]**

(1) 

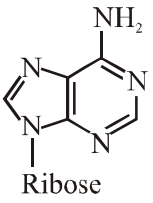
(2) 

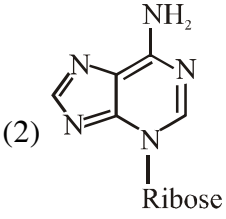
(3) 

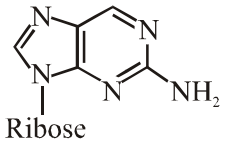
(4) 

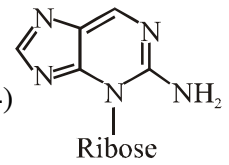
BM0126

17. Which of the following is the correct structure of Adenosine ? **[J-Main-2018]**

(1) 

(2) 

(3) 

(4) 

BM0127

18. Among the following, the incorrect statement is:- **[J-Main-2018]**

(1) Cellulose and amylose has 1, 4-glycosidic linkage.

(2) Lactose contains β-D-galactose and β-D-glucose.

(3) Maltose and lactose has 1, 4-glycosidic linkage.

(4) Sucrose and amylose has 1, 2-glycosidic linkage.

BM0128

19. The correct match between items of List-I and List-II is :- **[J-Main-2018]**

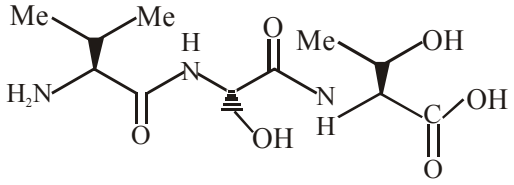
	Litst-I		**List-II**
(A)	Phenelzine	(P)	Pyrimidine
(B)	Chloroxylenol	(Q)	Furan
(C)	Uracil	(R)	Hydrazine
(D)	Ranitidine	(S)	Phenol

(1) (A)-(S), (B)-(R), (C)-(P), (D)-(Q) (2) (A)-(R), (B)-(S), (C)-(P), (D)-(Q)

(3) (A)-(S), (B)-(R), (C)-(Q), (D)-(P) (4) (A)-(R), (B)-(S), (C)-(Q), (D)-(P)

BM0129

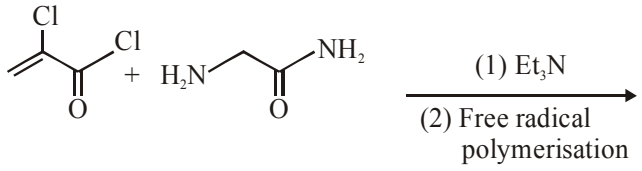
20. The correct sequence of amino acids present in the tripeptide given below is : **[J-Main-(Jan)-2019]**

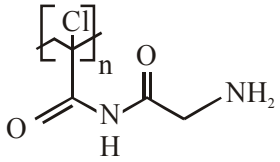


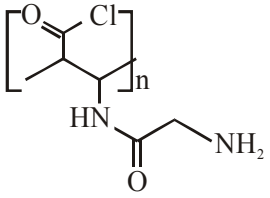
(1) Leu - Ser - Thr (2) Thr - Ser- Leu (3) Thr - Ser - Val (4) Val - Ser - Thr

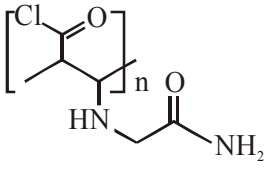
BM0130

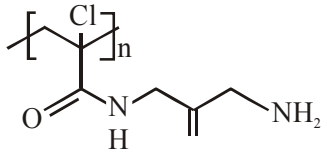
21. Major product of the following reaction is : **[J-Main-(Jan)-2019]**



(1) 

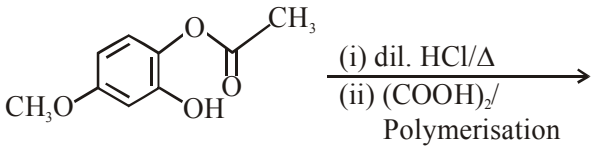
(2) 

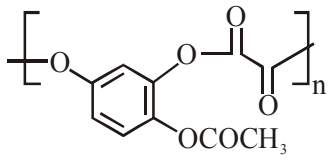
(3) 

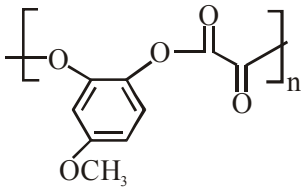
(4) 

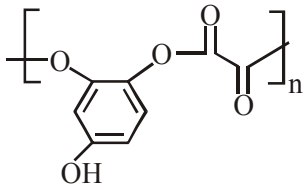
BM0131

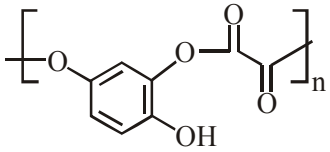
22. The major product of the following reaction is: **[J-Main-(Jan)-2019]**



(1) 

(2) 

(3) 

(4) 

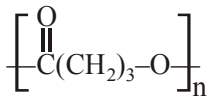
BM0132

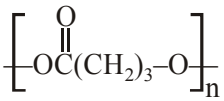
23. Which of the following tests cannot be used for identifying amino acids ? **[J-Main-(Jan)-2019]**

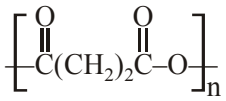
(1) Biuret test (2) Xanthoproteic test (3) Barfoed test (4) Ninhydrin test

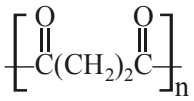
BM0133

24. The homopolymer formed from 4-hydroxy-butanoic acid is :- **[J-Main-(Jan)-2019]**

(1) 

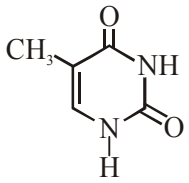
(2) 

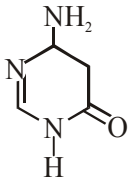
(3) 

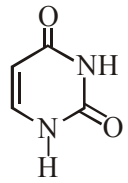
(4) 

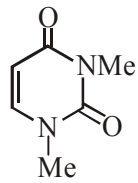
BM0134

25. Among the following compound which one is found in RNA ? **[J-Main-(Jan)-2019]**

(1) 

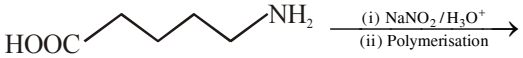
(2) 

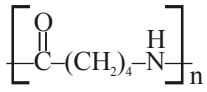
(3) 

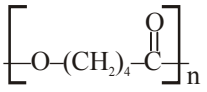
(4) 

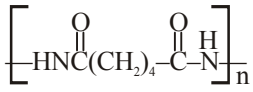
BM0135

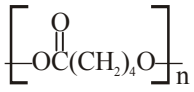
26. The polymer obtained from the following reactions is : **[J-Main-(Jan)-2019]**



(1) 

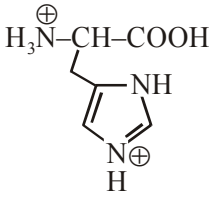
(2) 

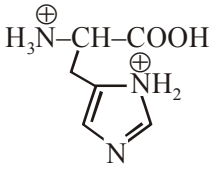
(3) 

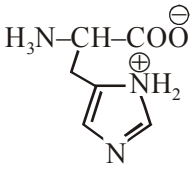
(4) 

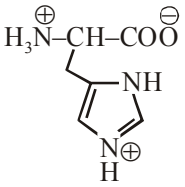
BM0136

27. The correct structure of histidine in a strongly acidic solution (pH=2) is **[J-Main-(Jan)-2019]**

(1) 

(2) 

(3) 

(4) 

BM0137

28. The two monomers for the synthesis of Nylone 6, 6 are : **[J-Main-(Jan)-2019]**

(1) $HOOC(CH_2)_6COOH$, $H_2N(CH_2)_6NH_2$ (2) $HOOC(CH_2)_4COOH$, $H_2N(CH_2)_4NH_2$

(3) $HOOC(CH_2)_6COOH$, $H_2N(CH_2)_4NH_2$ (4) $HOOC(CH_2)_4COOH$, $H_2N(CH_2)_6NH_2$

BM0138

29. Maltose on treatment with dilute HCI gives : **[J-Main-(April)-2019]**

(1) D-Galactose (2) D-Glucose

(3) D-Glucose and D-Fructose (4) D-Fructose

BM0139

30. Fructose and glucose can be distinguished by : **[J-Main-(April)-2019]**

(1) Fehling's test (2) Barfoed's test (3) Benedict's test (4) Seliwanoff's test

BM0140

31. The peptide that gives positive ceric ammonium nitrate and carbylamine tests is : **[J-Main-(April)-2019]**

(1) Lys-Asp (2) Ser-Lys (3) Gln-Asp (4) Asp-Gln

BM0141

32. Which of the following statements is not true about sucrose? **[J-Main-(April)-2019]**

(1) On hydrolysis, it produces glucose and fructose

(2) The glycosidic linkage is present between C_1 of α-glucose and C_1 of β-fructose

(3) It is also named as invert sugar

(4) It is a non reducing sugar

BM0142

33. Number of stereo centers present in linear and cyclic structures of glucose are respectively : **[J-Main-(April)-2019]**

(1) 4 & 5 (2) 5 & 5

(3) 4 & 4 (4) 5 & 4

BM0143

34. Amylopectin is composed of : **[J-Main-(April)-2019]**

(1) α-D-glucose, C_1–C_4 and C_1–C_6 linkages

(2) α-D-glucose, C_1–C_4 and C_2–C_6 linkages

(3) β-D-glucose, C_1–C_4 and C_2–C_6 linkages

(4) β-D-Glucose, C_1–C_4 and C_1–C_6 linkages

BM0144

35. Which of the following statements is not true about RNA ? **[J-Main-(April)-2019]**

(1) It has always double stranded α-helix structure

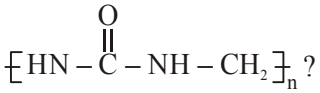
(2) It usually does not replicate

(3) It is present in the nucleus of the cell

(4) It controls the synthesis of protein

BM0145

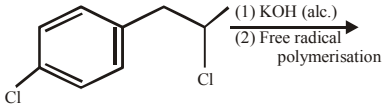
36. Which of the following compounds is a constituent of the polymer **[J-Main-(April)-2019]**

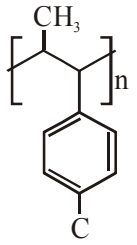


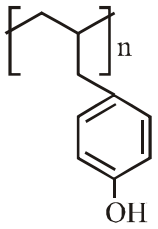
(1) Formaldehyde (2) Ammonia (3) Methylamine (4) N-Methyl urea

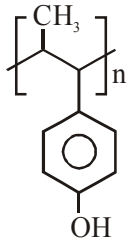
BM0146

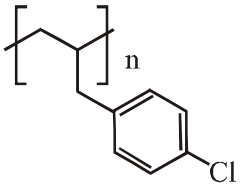
37. The major product of the following reaction is : **[J-Main-(April)-2019]**



(1) 

(2) 

(3) 

(4) 

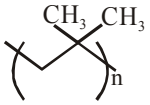
BM0147

38. Which of the following is a condensation polymer ? **[J-Main-(April)-2019]**

(1) Buna - S (2) Nylon 6, 6 (3) Teflon (4) Neoprene

BM0148

39. The correct name of the following polymer is: **[J-Main-(April)-2019]**



(1) Polyisoprene (2) Polytert-butylene (3) Polyisobutane (4) Polyisobutylene

BM0149

40. Which of the following is a thermosetting polymer? **[J-Main-(April)-2019]**

(1) Buna–N (2) PVC (3) Bakelite (4) Nylon 6

BM0150

41. Which of the following statements is correct- **[J-Main-(Jan)-2020]**

(1) Gluconic acid can form cyclic (acetal/ hemiacetal) structure

(2) Gluconic acid is a partial oxidation product of glucose

(3) Gluconic acid is obtained by oxidation of glucose with HNO_3

(4) Gluconic acid is a dicarboxylic acid

BM0151

42. Match the following : **[J-Main-(Jan)-2020]**

(i)	Riboflavin	(a) Beriberi
(ii)	Thiamine	(b) Scurvy
(iii)	Pyridoxine	(c) Cheilosis
(iv)	Ascorbic acid	(d) Convulsions

(1) (i)-(c), (ii)-(a), (iii)-(d), (iv)-(b)
(2) (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b)
(3) (i)-(d), (ii)-(b), (iii)-(a), (iv)-(c)
(4) (i)-(a), (ii)-(d), (iii)-(c), (iv)-(b)

BM0152

43. Two monomers in maltose are : **[J-Main-(Jan)-2020]**

(1) α-D-glucose and β-D-glucose
(2) α-D-glucose and α-D-Fructose
(3) α-D-glucose and α-D-glucose
(4) α-D-glucose and α-D-galactose

BM0153

44. A, B and C are three biomolecules. The results of the tests performed on them are given below: **[J-Main-(Jan)-2020]**

	Molisch's Test	Barfoed Test	Biuret Test
A	Positive	Negative	Negative
B	Positive	Positive	Negative
C	Negative	Negative	Positive

A, B and C are respectively :

(1) A = Glucose, B = Fructose, C = Albumin
(2) A = Lactose, B = Fructose, C = Alanine
(3) A = Lactose, B = Glucose, C = Alanine
(4) A = Lactose, B = Glucose, C = Albumin

BM0154

EXERCISE # J-ADVANCED_(OBJECTIVE)

1. **Statement-1** : p-Hydroxybenzoic acid has a lower boiling point than o-hydroxybenzoic acid.
because **[JEE 2007]**
Statement-2 : o-Hydroxybenzoic acid has intramolecular hydrogen bonding.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

BM0155

2. 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. **[JEE 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

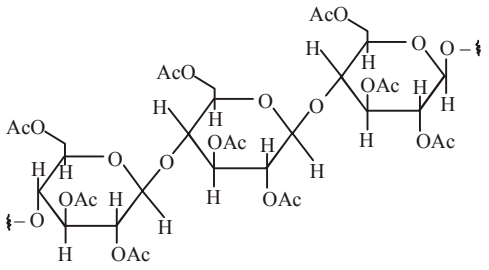
BM0156

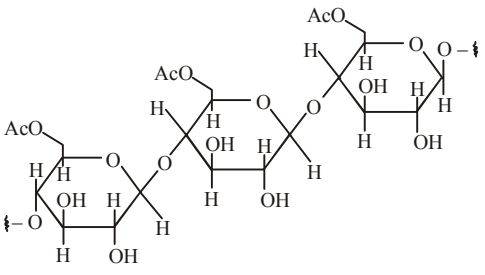
3. Match the compounds/ion in column I with their properties/ reaction in Column II. Indicate your answer by darkening the appropriate bubbles of the 4 × 4 matrix given in the ORS. **[JEE 2007]**

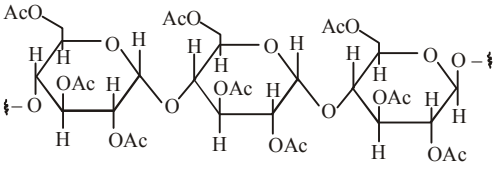
Column I	**Column II**
(A) C_6H_5CHO	(P) gives precipitate with 2,4-dinitrophenylhydrazine
(B) $CH_3C{\equiv}CH$	(Q) gives precipitate with $AgNO_3$
(C) CN^-	(R) is a nucleophile
(D) I^-	(S) is involved in cyanohydrin formation

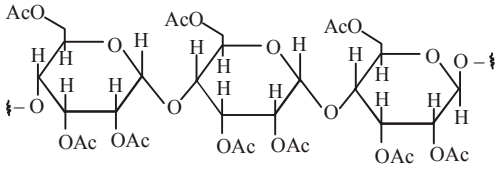
BM0157

4. Cellulose upon acetylation with excess acetic anhydride / H_2SO_4 (catalytic) gives cellulose triacetate whose structure is **[JEE 2008]**

(A) 

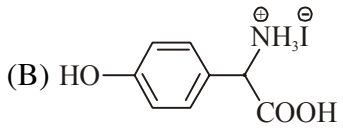
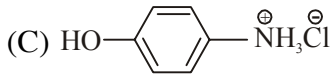
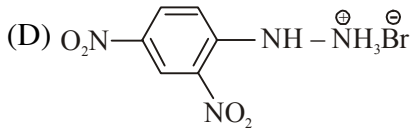
(B) 

(C) 

(D) 

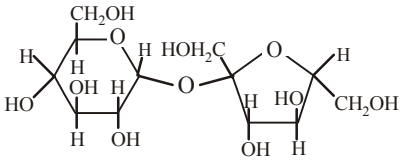
BM0158

5. Match the compounds in **Column I** with their characteristic test(s)/reaction(s) given in **Column II**. Indicate your answer by darkening the appropriate bubbles of the 4 × 4 matrix given in the ORS. **[JEE 2008]**

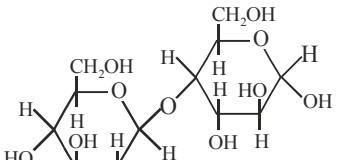
Column-I	**Column II**
(A) $H_2N - \overset{\oplus}{N}H_3\overset{\ominus}{Cl}$	(P) Sodium fusion extract of the compound gives Prussian blue colour with $FeSO_4$
(B) 	(Q) Gives positive $FeCl_3$ test
(C) 	(R) Gives white precipitate with $AgNO_3$
(D) 	(S) Reacts with aldehydes to form the corresponding Hydrazone derivative

BM0159

6. The correct statement(s) about the following sugars X and Y is(are) **[JEE 2009]**



(X)



(Y)

(A) X is a reducing sugar and Y is a non-reducing sugar
(B) X is a non-reducing sugar and Y is a reducing sugar
(C) The glucosidic linkages in X and Y are α and β , respectively.
(D) The glucosidic linkages in X and Y are β and α , respectively

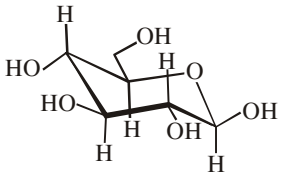
BM0160

7. Among cellulose, poly(vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is **[JEE 2009]**

(A) Nylon
(B) Poly (vinyl chloride)
(C) Cellulose
(D) Natural Rubber

BM0161

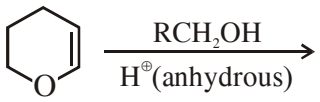
8. The following carbohydrate is **[JEE 2011]**



(A) a ketohexose
(B) an aldohexose
(C) an α-furanose
(D) an α-pyranose

BM0162

9. The major product of the following reaction is **[JEE 2011]**

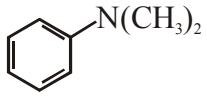
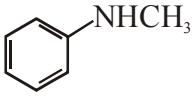
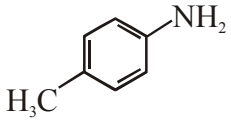
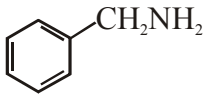


(A) a hemiacetal
(B) an acetal
(C) an ether
(D) an ester

BM0163

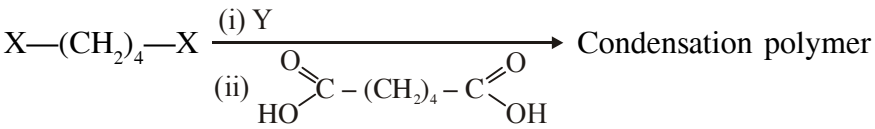
10. Amongst the compounds given, the one that would form a brilliant coloured dye on treatment with $NaNO_2$ in dil. HCl followed by addition to an alkaline solution of β-naphthol is -

[JEE 2011]

(A) 
(B) 
(C) 
(D) 

BM0164

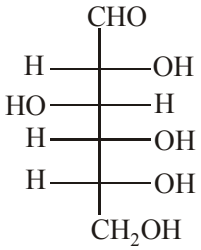
11. The correct functional group X and the reagent/reaction conditions Y in the following scheme are **[JEE 2011]**



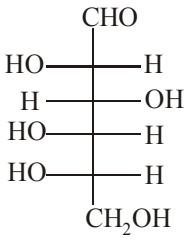
(A) X = $COOCH_3$, Y = H_2 / Ni / heat
(B) X = $CONH_2$, Y = H_2 / Ni / heat
(C) X = $CONH_2$, Y = Br_2 / NaOH
(D) X = CN, Y = H_2 / Ni / heat

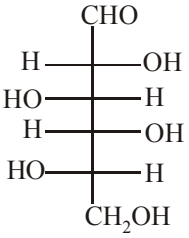
BM0165

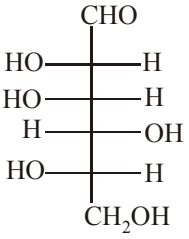
12. The structure of D-(+)-glucose is **[IIT 2011]**

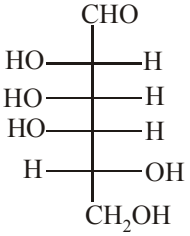


The structure of L(–)-glucose is

(A) 

(B) 

(C) 

(D) 

BM0166

13. For 'invert sugar', the correct statement(s) is (are) : **[JEE 2016]**

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

(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 surgar' is –20°

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

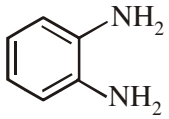
BM0167

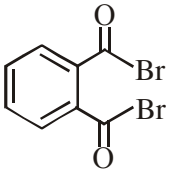
Comprehension : Q.No. 14 to 15

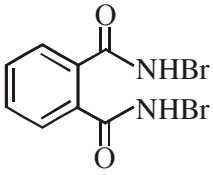
Treatment of compound **O** with $KMnO_4$ / H^+ gave **P**, which on heating with ammonia gave **Q**. The compound **Q** on treatment with Br_2 / NaOH produced **R**. On strong heating, **Q** gave **S**, which on further treatmenet with ethyl 2-bromopropanoate in the presence of KOH following by acidification, gave a compound **T**.

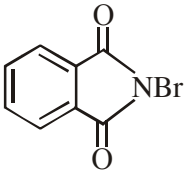
(O)

14. The compound **R** is : **[JEE 2016]**

(A) 

(B) 

(C) 

(D) 

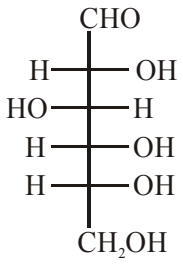
BM0168

15. The compound **T** is : **[JEE 2016]**

(A) Glycine (B) Alanine (C) Valine (D) Serine

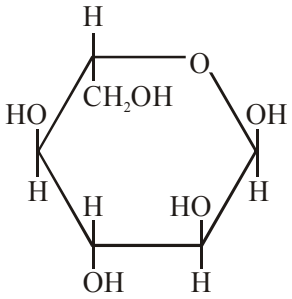
BM0169

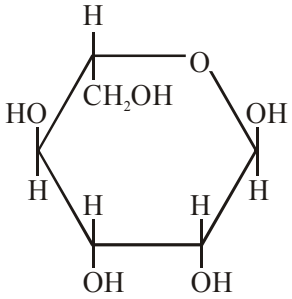
16. The Fischer presentation of D-glucose is given below. **[JEE 2018]**

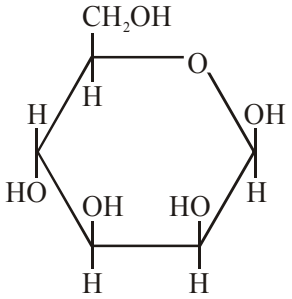


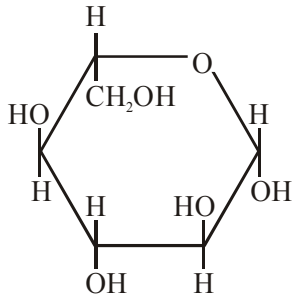
D-glucose

The correct structure(s) of β-L-glucopyranose is (are) :-

(A)


(B)


(C)


(D)


BM0170

17. Which of the following statement(s) is(are) true ? **[JEE 2019]**

(A) Oxidation of glucose with bromine water gives glutamic acid

(B) The two six-membered cyclic hemiacetal forms of D-(+)-glucose ard called anomers

(C) Hydrolysis of sucrose gives dextrorotatory glucose and laevorotatory fructose

(D) Monosaccharides **cannot** be hydrolysed to give polyhydroxy aldehydes and ketones

BM0171

18. Choose the correct option(s) from the following **[JEE 2019]**

(A) Natural rubber is polyisoprene containing *trans* alkene units

(B) Nylon-6 has amide linkages

(C) Cellulose has only α-D-glucose units that are joined by glycosidic linkages

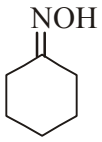
(D) Teflon prepared by heating tetrafluoroethene in presence of a persulphate catalyst at high pressure

BM0172

EXERCISE # J-ADVANCED_(SUBJECTIVE)

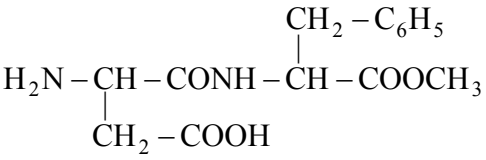
1. Give the structures of the products in each of the following reactions. **[JEE 2000]**

(i) Sucrose $\xrightarrow{H^+}$ A + B

(ii)  $\xrightarrow{H^+}$ C $\xrightarrow{\text{Polymerisation}}$ $[-D-]_n$

BM0173

2. Aspartame, an artifical sweetener, is a peptide and has the following structure: **[JEE 2001]**



(i) Identify the four functional groups

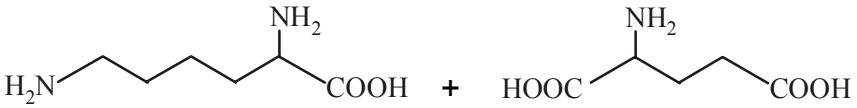
(ii) Write the zwitterionic structure

(iii) Write the structures of the amino acids obtained from the hydrolysis of aspartame

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

BM0174

3. Following two amino acids lysine and glutamine form dipeptide linkage. What are two possible dipeptides ? **[JEE 2003]**

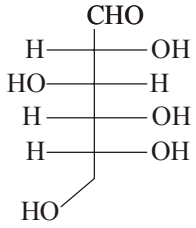


BM0175

4. The structure of D-Glucose is as follows- **[JEE 2004]**

(a) Draw the structure of L -Glucose

(b) Give the reaction of L - Glucose with Tollens reagent.



BM0176

5. Monomer A of a polymer on ozonolysis yields two moles of HCHO and one mole of CH_3COCHO.

(a) Deduce the structure of A. **[JEE 2005]**

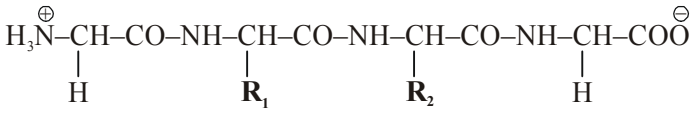
(b) Write the structure of "all cis" – form of polymer of compound A.

BM0177

6. 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 **[JEE 2011]**

BM0178

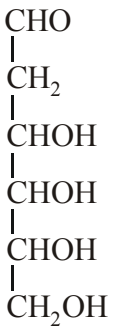
7. The substitutes $\mathbf{R_1}$ and $\mathbf{R_2}$ for nine peptides are listed in the table given below. How many of these peptides are positively charged at pH = 7.0 ? **[JEE 2012]**



Peptide	$\mathbf{R_1}$	$\mathbf{R_2}$
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

BM0179

8. When the following aldohexose exists in its d-configuration , the total number of stereoisomers in its pyranose form is - **[JEE 2012]**



BM0180

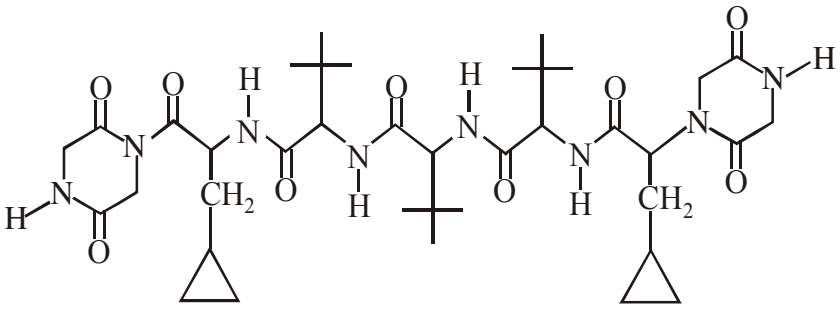
9. A tetrapeptide has –COOH group on alanine. This produces glycine (Gly), valine (Val), phenyl alanine (Phe) and alanine (Ala), on complete hydrolysis. For this tetrapeptide, the number of possible sequences (Primary structures) with $-NH_2$ group attached to a chiral center is **[JEE 2013]**

BM0181

10. The total number of lone-pairs of electrons in melamine is : **[JEE 2013]**

BM0182

11. The total number of ***distinct naturally occurring amino acids*** obtained by complete acidic hydrolysis of the peptide shown below is : **[JEE 2014]**



BM0183

ANSWER KEY

EXERCISE # O-I

1.	**Ans. (C)**	**2.**	**Ans. (D)**	**3.**	**Ans. (C)**	**4.**	**Ans. (B)**	**5.**	**Ans. (C)**
6.	**Ans. (A)**	**7.**	**Ans. (C)**	**8.**	**Ans. (D)**	**9.**	**Ans. (C)**	**10.**	**Ans. (B)**
11.	**Ans. (B)**	**12.**	**Ans. (C)**	**13.**	**Ans. (C)**	**14.**	**Ans. (A)**	**15.**	**Ans. (A)**
16.	**Ans. (D)**	**17.**	**Ans. (D)**	**18.**	**Ans. (D)**	**19.**	**Ans. (B)**	**20.**	**Ans. (B)**
21.	**Ans. (D)**	**22.**	**Ans. (B)**	**23.**	**Ans. (A)**	**24.**	**Ans. (A)**	**25.**	**Ans. (C)**
26.	**Ans. (A)**	**27.**	**Ans. (D)**	**28.**	**Ans. (B)**	**29.**	**Ans. (B)**	**30.**	**Ans. (C)**
31.	**Ans. (C)**	**32.**	**Ans. (C)**	**33.**	**Ans. (D)**	**34.**	**Ans. (C)**	**35.**	**Ans. (A)**
36.	**Ans. (D)**	**37.**	**Ans. (B)**	**38.**	**Ans. (C)**	**39.**	**Ans. (A)**	**40.**	**Ans. (A)**
41.	**Ans. (B)**	**42.**	**Ans. (B)**						

EXERCISE # O-II

1.	**Ans.(A,B,C,D)**	**2. Ans.(A,B,D)**	**3. Ans.(A,B,C)**	**4. Ans.(A,B,D)**	**5. Ans.(A,B,D)**
6.	**Ans.(A,B,C)**	**7. Ans.(B,C)**	**8. Ans.(A,B,C,D)**	**9. Ans.(A,B,C)**	**10. Ans.(B,D)**
11.	**Ans. (D)**	**12. Ans.(A)**	**13. Ans.(D)**	**14. Ans.(B)**	**15. Ans.(C)**

16. Ans.(A) → P, Q, S ; (B) → S ; (C) → R, S ; (D) → Q,R, S

17. Ans.(A) → R ; (B) → P ; (C) → S ; (D) → Q

EXERCISE # S-I

Assertion Reason

1.	**Ans. (A)**	**2.**	**Ans. (A)**	**3.**	**Ans. (A)**	**4.**	**Ans. (A)**	**5.**	**Ans. (D)**
6.	**Ans. (B)**	**7.**	**Ans. (C)**	**8.**	**Ans. (A)**	**9.**	**Ans. (C)**		

Match the Column

10. Ans. (A) → S ; (B) → Q ; (C) → P ; (D) → R

11. Ans. (A) → Q , S ; (B) → Q , R, S ; (C) → P, R, T, U (D) → P, S, T, U

12. Ans. (A) → P, Q, R ; (B) → P ; (C) → P,S ; (D) → P, Q, R

13. Ans. (A) → Q, R (B) → P, (C) →S; (D) →T

14. Ans. (A)→P, Q, R ; (B) → S ; (C)→R ; (D) → P, Q, S

15. Ans. (A) → S-W (B) → P-Y, R-X (C) → Q-Z

Subjective Type :

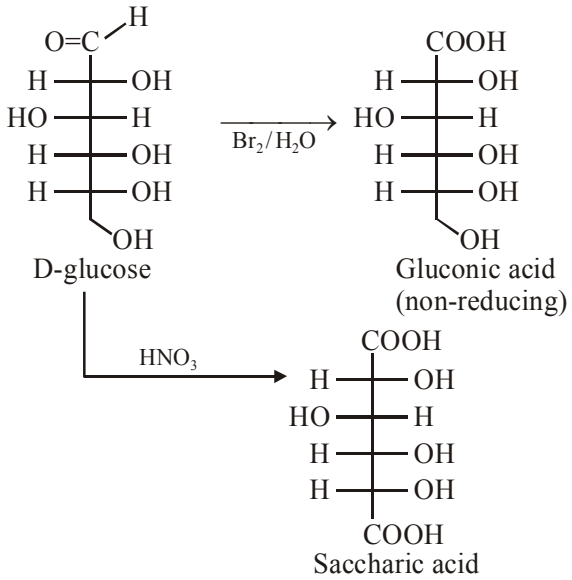
16. Ans. (3.25)

EXERCISE # J-MAIN

1.	**Ans. (2)**	**2.**	**Ans. (2)**	**3.**	**Ans. (4)**	**4.**	**Ans. (3)**	**5.**	**Asn. (3)**
6.	**Ans. (3)**	**7.**	**Ans. (3)**	**8.**	**Ans. (4)**	**9.**	**Ans. (1)**	**10.**	**Ans. (1)**
11.	**Ans. (1)**	**12.**	**Ans. (1)**	**13.**	**Ans. (4)**	**14.**	**Ans. (2)**	**15.**	**Ans. (1)**
16.	**Ans. (4)**	**17.**	**Ans. (1)**	**18.**	**Ans. (4)**	**19.**	**Ans. (2)**	**20.**	**Ans. (4)**
21.	**Ans. (4)**	**22.**	**Ans.(2)**	**23.**	**Ans.(3)**	**24.**	**Ans. (1)**	**25.**	**Ans. (3)**
26.	**Ans. (2)**	**27.**	**Ans.(1)**	**28.**	**Ans.(4)**	**29.**	**Ans.(2)**	**30.**	**Ans.(4)**
31.	**Ans. (2)**	**32.**	**Ans. (2)**	**33.**	**Ans. (1)**	**34.**	**Ans.(1)**	**35.**	**Ans. (1)**
36.	**Ans. (1)**	**37.**	**Ans. (1)**	**38.**	**Ans. (2)**	**39.**	**Ans. (4)**	**40.**	**Ans. (3)**

41. Ans. (2)

Sol.



42. Ans. (1)

Sol. (i) Riboflavin ⟶ (c) Cheilosis

(ii) Thiamine ⟶ (a) Beriberi

(iii) Pyridoxin ⟶ (d) Convulsions

(iv) Ascorbic acid ⟶ (b) Scurvy

43. Ans. (3)

Sol. Two monomers in maltose are α-D-glucose & α-D-glucose.

44. Ans. (4)

Sol. Alanine does not show Biuret test because Biuret test is used for deduction of peptide linkage & alanine is amino acid.

Albumine is protein so have paptide linkage so it gives positive Biuret test.

Positive Barfoed test is shown by monosaccharide but not disaccharide. Positive Molisch's test is shown by glucose.

EXERCISE # J-ADVANCED_(OBJECTIVE)

1. **Ans.(D)** **2.** **Ans.(A) → P, S ; (B) → Q, R ; (C) → P, R ; (D) → S**

3. **Ans.(A) → P, S ; (B) → Q ; (C) → Q, R, S ; (D) → Q, R** **4.** **Ans.(A)**

5. **Ans.(A) → R, S ; (B) → P, Q ; (C) → P, Q, R ; (D) → P, S** **6.** **Ans.(B,C)**

7. **Ans.(D)** **8.** **Ans.(B)** **9.** **Ans.(B)** **10.** **Ans.(C)** **11.** **Ans.(A,B,C,D)**

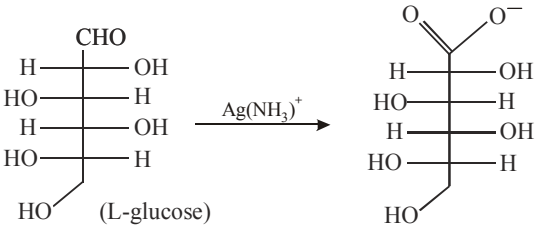
12. **Ans.(A)** **13.** **Ans.(B,C)** **14.** **Ans.(A)** **15.** **Ans.(B)** **16.** **Ans.(D)**

17. **Ans.(B,C,D)** **18.** **Ans.(B,D)**

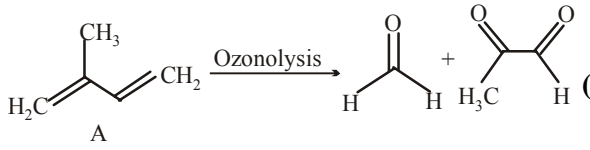
EXERCISE # J-ADVANCED_(SUBJECTIVE)

2. **Ans. (i) Amine, carboxylic acid, Amide, Ester**

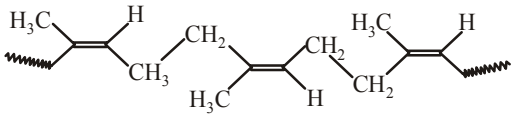
4. **Ans.**



5. **Ans. (a)**



(b)



6. **Ans.(6)** **7.** **Ans.(4)** **8.** **Ans.(8)** **9.** **Ans.(4)** **10.** **Ans.(6)**

11. **Ans.(1)**