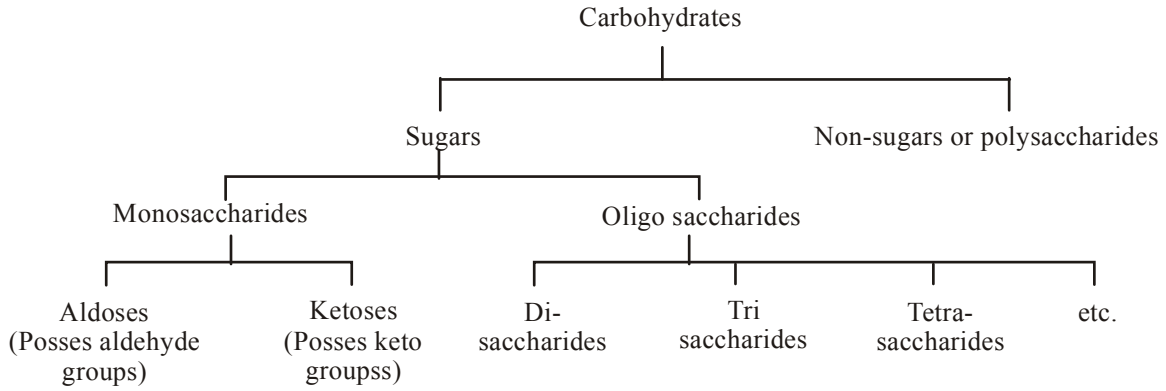
13

BIOMOLECULES, CHEMISTRY IN EVERYDAY LIFE & POLYMERS

CARBOHYDRATES

These are naturally occurring substances composed of carbon, hydrogen and oxygen. The last two elements being present in the same ratio as they are present in water. Thus, the empirical formula of carbohydrates is CH_2O where as the general formula is $C_x(H_2O)_y$. All the compounds satisfying the formula $C_X(H_2O)_Y$ are not carbohydrates, e.g., $C_3H_6O_3$. There are some carbohydrates which do not satisfy the general formula, for example rhamnose $C_6H_{12}O_5$, rhamnohexose $C_7H_{14}O_6$, etc. A close study of properties of carbohydrates reveals that they are optically active polyhydroxy aldehydes or ketones.

Classification of Carbohydrates : They are broadly classified as :



Sugars : These are sweet tasting, crystalline solids, soluble in water. They may be reducing or non-reducing sugars. Reducing sugars reduce Tollen's reagent, Fehling solution, Benedict solution, etc.

Monosaccharides : These are the simplest sugars. They are nonhydrolysable, optically active, polyhydroxy aldehydes or ketones. Their general formula is $[CH_2O]_n$, n = 3 to 7. They are further classified depending upon the nature of the carbonyl group and number of carbon atoms.

Molecular formula	Group Name	Specific Example
$C_3H_6O_3$	Triose	Glycerose
$C_4H_8O_4$	Tetrose	Erythrose, Threose
$C_5H_{10}O_5$	Pentose	Aldopentose → Ribose xylose Arebinose
		Ketopentose → Ribulose xylulose
$C_6H_{12}O_6$	Hexose	Aldohexose → Glucose, Mannose, Galactose
		Ketohexose → Fructose

Oligo saccharides : These produce 2 to 10 monosaccharides on hydrolysis. Some important oligo saccharides are :

(i) **Disaccharides, $C_{12}H_{22}O_{11}$** : They give two monosaccharide molecules on hydrolysis.

For example,

Disaccharide	Hydrolysis Product
Sucrose	Glucose + Fructose
Maltose	Glucose + Glucose
Lactose	Glucose + Galactose

(ii) **Trisaccharides, $C_{18}H_{32}O_{16}$:** These yield three monosaccharide molecules on hydrolysis, For Example, Raffinose.

(iii) **Tetrasaccharides, $C_{24}H_{42}O_{21}$:** Which yield four monosaccharide molecules on hydrolysis, e.g., stachyose.

Non–Sugars or Polysaccharides : They are amorphous solids either insoluble in water or form colloidal solutions. They have no taste. They yield a large number of monosaccharide molecules on hydrolysis. For example, cellulose starch, glycogen, pentosans, Glucose, Dextrose, Grape Sugar, Corn Sugar and Blood Sugar, $C_6H_{12}O_6$

GLUCOSE : ($C_6H_{12}O_6$) :

Occurrence : Glucose is found in free as well as combined state in plants and animals. Its important sources are cane sugar, ripe fruits, grapes, honey, human blood and urine of diabetic patients. Glucose is the building unit of starch and cellulose.

Preparation :

From Sucrose : By its hydrolysis

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\Delta]{\text{dil. } H_2SO_4} C_6H_{12}O_6 + C_6H_{12}O_6$$

Cane Sugar — Glucose — Fructose

Glucose and fructose are separated from their mixture by means of $Ca(OH)_2$. Calcium glucosate is soluble while calcium fructosate is insoluble in water.

(From starch) –

$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow[\text{Under pressure}]{\text{Dil. } H_2SO_4, \Delta} nC_6H_{12}O_6(aq)$$

Glucose

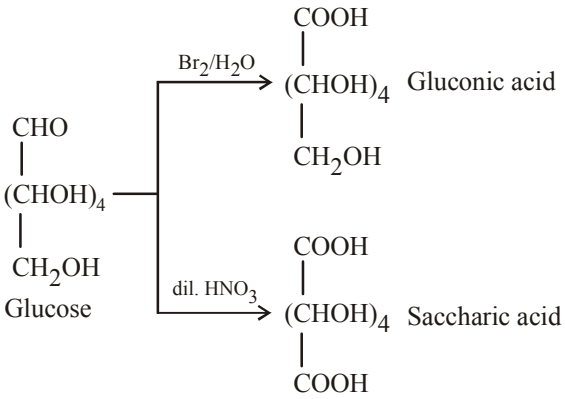
The free acid is neturalized with $CaCO_3$ and filtered. The filtrate is decolourized by animal charcoal and conc. in vacuum pans to give crystals of glucose.

Properties : It is a white crystalline solid, melting point 146ºC, sweet in taste but not as sweet as cane sugar. It produces cooling on keeping on the tongue, soluble in water, sparingly soluble in alcohol and insoluble in ether. It rotates the plane of polarization of plane polarized light towards right hand side, hence the name dextrose.

Glucose molecule contains four chiral carbons. It exists in 16-optically active forms.

Chemical properties

Oxidation :



Reduction :

$HOCH_2 \bullet (CHOH)_4 \bullet CHO + 2[H]$

Glucose

$$\xrightarrow{Na-Hg/H_2O} HOCH_2 \bullet (CHOH)_4 \bullet CH_2OH$$

Sorbitol (Hexahydric alcohol)

$$HOCH_2 \bullet (CHOH)_4 \bullet CHO \xrightarrow[150°C]{\text{Red dP/HI}} CH_3 \bullet (CH_2)_4 \bullet CH_3$$

n–Hexane

Reducing nature :

$HOCH_2 \bullet (CHOH)_4 \bullet CHO + Ag_2O$

$$\xrightarrow[(\text{Amm. } AgNO_3)]{\text{Tollen's reagent}} HOCH_2 \bullet (CHOH)_4 \bullet COOH + 2Ag\downarrow$$

Silver mirror

$HOCH_2 \bullet (CHOH)_4 \bullet CHO + 2CuO$

$$\xrightarrow[\Delta]{\text{Fehling's solution}} HOCH_2 \bullet (CHOH)_4 \bullet COOH + Cu_2O\downarrow$$

Red ppt

Reaction with HCN

$HOCH_2 \bullet (CHOH)_4 \bullet CHO + HCN$

$\longrightarrow HOCH_2 \bullet (CHOH)_4 \bullet CH(OH)CN$

Glucose cyanohydrin

This reaction is used for stepping up of an aldose by Killiani-synthesis.

Reaction with NH_2OH %

$HOCH_2 \bullet (CHOH)_4 \bullet CHO + H_2NOH$

$\longrightarrow HOCH_2 \bullet (CHOH)_4 \bullet CH{=}NOH + H_2O$

Glucose oxime

By this reaction we obtain higher aldose to lower aldose. This reaction is known **as Whol degradation.**

Reaction with phenyl hydrazine %

$HOCH_2 \bullet (CHOH)_4 \bullet CHO + 3C_6H_5NH \bullet NH_2$

Glucose (1 mole) Phenyl hydrazine (3 moles)

$\longrightarrow$ Glucose osazone

Osazones of glucose, fructose and mannose are identical.

Acetylation : Glucose forms penta-acetyl derivative on reaction with excess of acetic anhydride. It indicates the presence of five –OH groups in the glucose molecule.

Reaction with alkali % When warmed with dilute alkali, glucose yields a mixture of glucose, mannose and fructose. The same mixture is obtained if the starting material is fructose or mannose. This rearrangement is known as Lobry de Bruyn van Ekenstein rearrangement.

Reaction with carbohydrates should be carried out in acidic or neutral medium because under alkaline conditions they undergo rearrangement.

Fermentation :

$$C_6H_{12}O_6 \xrightarrow[\text{Yeast}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

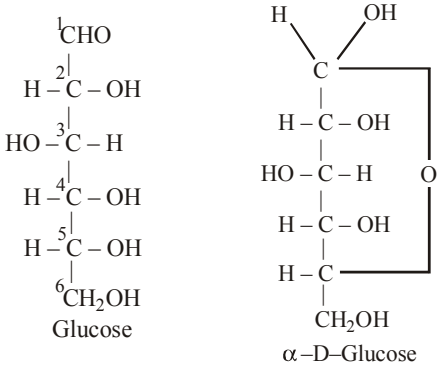
Ring structure for glucose :

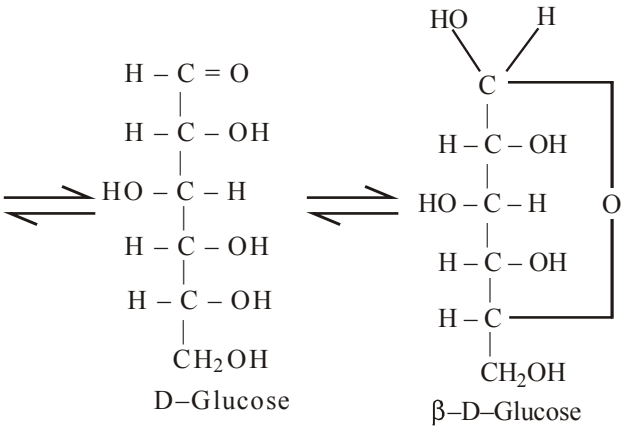
The following facts are explained.

(1) **Mutarotation :** The specific rotation of a freshly prepared solution of glucose changes with time and finally attains a constant value. This phenomenon is called mutarotation.

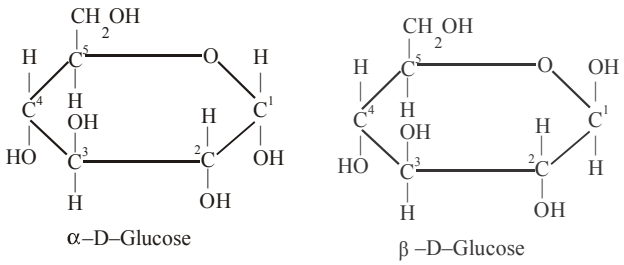
(2) Glucose does not form bisulphite compound with $NaHSO_3$, does not react with ammonia, does not restore the pink colour of Schiff's reagent.

Glucose has six membered pyranose ring structure.

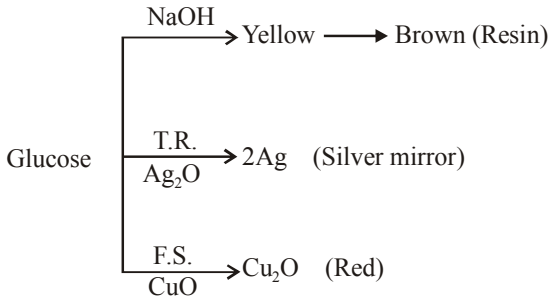




Pyranose ring structures of α—D and β—D-Glucose



Test for Glucose :



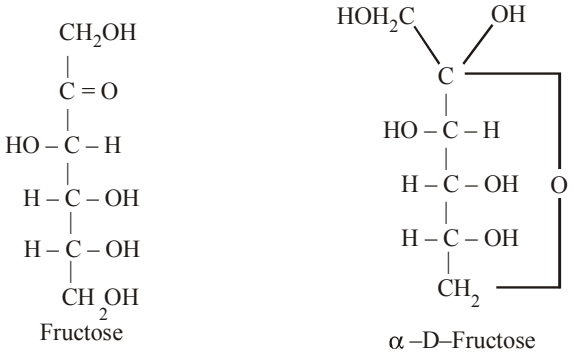
Molish test : Aqueous solution of glucose + α-Nepthal + $C_2H_5OH \xrightarrow{\text{conc. } H_2SO_4}$ indigo colour

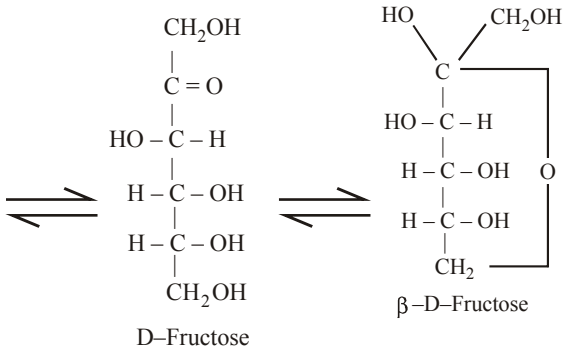
Uses of Glucose :

(i) As a food for babies and invalids. It is given to players as an instant source of energy.
(ii) For silvering of mirrors.
(iii) For preparing vitamin C (ascorbic acid)
(iv) For making alcohol by fermentation.
(v) For making sweets, jams, jellies, biscuits etc.
(vi) In medicine, calcium glucosate is used for treatment of calcium deficiency.

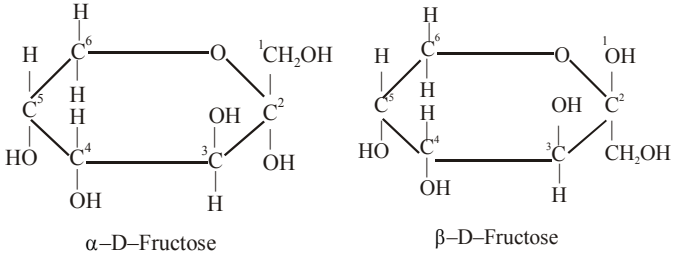
FRUCTOSE, $C_6H_{12}O_6$

Occurrence : Fructose is found in ripened fruits and honey. It is leavo rotatory and hence the name levulose. It contains three different asymmetric carbon atoms and so exists in eight optically isomeric forms. It is the sweetest of all the sugars.

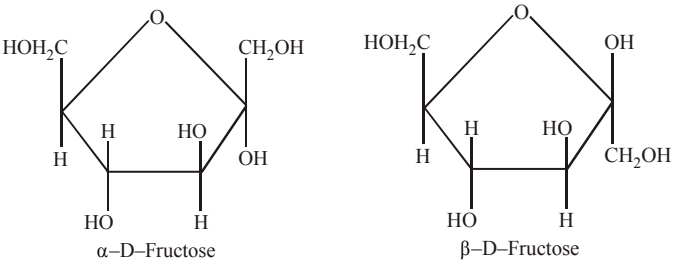




In form of Pyromose ring structure :



In form of furanose structure :



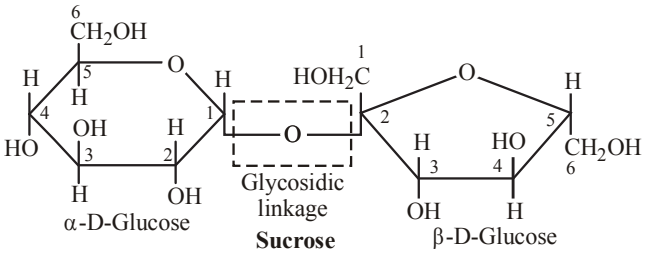
Some important characteristics of fructose are :

It is a ketonic sugar. It behaves like a ketohexose. It shows mutarotation i.e. specific rotation of a freshly prepared fructose solution changes with time. It suggests its ring structure. Fructose on reduction with Na–Hg/H_2O forms a mixture of sorbitol and mannitol. Fructose is not oxidised by Br_2 water but with HNO_3 it forms a mixture of glycollic and tartaric acids. Fructose forms a pentaacetate with excess of acetic anhydride indicating the presence of five –OH groups in its molecule. The pentaacetate looses reducing properties.

Fructose is a reducing sugar. It reduces Tollen's reagent giving silver mirror, Fehling's solution giving a red ppt. of $_2O$, etc. Although fructose is a ketonic sugar yet it reduces Tollen's reagents, etc. is due to the fact that under alkaline conditions it rearranges to give a mixture of glucose, mannose and fructose. Glucose and mannose are aldehydic sugars and hence reducing in nature. Fructose (1 mole) forms osazone with phenyl hydrazine (3 mole) which is quite identical with glucose and mannose and fructose osazone . Zymase ferments fructose to ethanol and CO_2. Fructose is a functional isomer of glucose.

SUCROSE, CANE SUGAR, $C_{12}H_{22}O_{11}$:

Occurrence : It occurs naturally in sugar cane and beet root. It is also found in honey, pineapples, bananas and several other ripened fruits. Molasses is the mother liquor left after the crystallization of sugar from the sugar cane juice. It is a colourless, crystalline, solid, highly soluble in water.



Main Properties :

Hydrolysis :

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{invertase(yeast)}]{\text{Dil. Acid or}} C_6H_{12}O_6 + C_6H_{12}O_6$$

Glucose Fructose

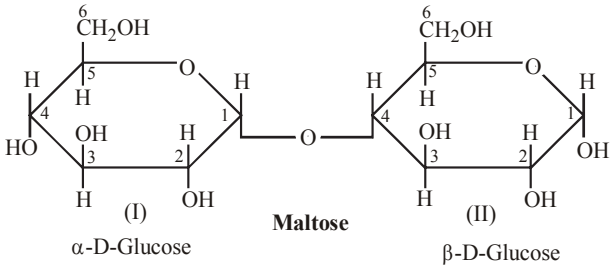
The hydrolysis of cane sugar is called inversion. An equimolecular mixture of glucose and fructose is called invert sugar. Invert sugar is sweeter than sucrose due to the presence of fructose. Sucrose (cane sugar) is dexro-rotatory, but invert sugar is levorotatory, because the levorotation of fructose in invert sugar is more than dextro rotation of glucose.

Acetylation : Sucrose forms sucrose octaacetate indicating that sucrose molecule contains eight – OH groups.
Sucrose octaacetate is used for preparing denatured spirit.

Non-reducing nature : Sucrose does not contain a free aldehydic or ketonic group so it does not show mutarotation. It does not reduce Fehling solution or Tollen's reagent. It does not form cyanohydrin, oxime or osazone.

MALTOSE, MALT SUGAR, $C_{12}H_{22}O_{11}$:

It is obtained by the action of enzyme diastase present in germinated barley on starch.
It is a white crystalline solid, m.p. 160°C. It is highly soluble in water and the solution rotates the plane of polarised light towards right hand side (dextro rotatory). It is about one third as sweet as cane sugar. It is a reducing sugar. It reduces Fehling's solution, forms oxime and osazone and shows the phenomenon of mutarotation. On hydrolysis with dil. HCl or the enzyme maltase, it gives two molecules of glucose.



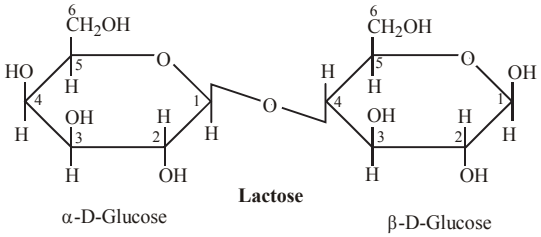
$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{Maltase}]{\text{conc. HCl}} C_6H_{12}O_6 + C_6H_{12}O_6$$

Maltose Glucose Glucose

Uses : Maltose is used in the manufacture of malted milk and various types of baby foods.

LACTOSE, MILK SUGAR, $C_{12}H_{22}O_{11}$:

It occurs in the milk of all animals, hence the name **milk sugar**. It is sweet in taste but much less than sucrose. It is manufactured by evaporating whey, a by-product obtained in the manufacture of cheese, and crystallizing the concentrated solution.
Lactose is a white crystalline solid, m.p. 203°C. It dissolves in water and is optically active (dextro rotatory). It is a reducing sugar. Its solution shows mutarotation. It gives an oxime and osazone. It reduces Tollen's reagent, Fehling solution, etc.



On hydrolysis, lactose gives equimolecular amounts of D-glucose and D-galactose.

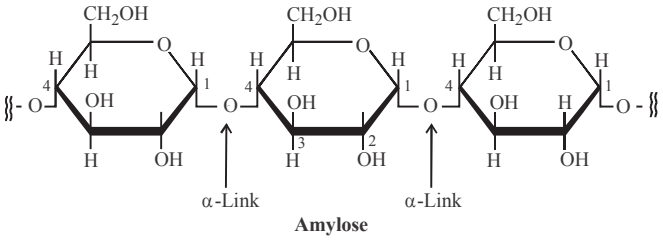
$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{conc. HCl}} C_6H_{12}O_6 + C_6H_{12}O_6$$

Glucose Galactose

STARCH, AMYLUM, $(C_6H_{10}O_5)_n$:

Starch is an important plant polysaccharide. It's general formula is $(C_6H_{10}O_5)_n$. n = 200 to 1000. It consist of α – glucose and is made up of two components (i) Amylose (ii) Amylopectin

Amylose – It is a linear polymer containing α – glucose as the structural units. Amylose is water soluble.



Amylopectin – It is the water insoluble component of starch, It is made up of several short branched chains of α–glucose unit. It is an important carbohydrate in our diet. It is found in plants as reserved food material. Rice, wheat, maize and other cereals contain 60–80% starch. Potatoes also contain about 15-20% starch. Rice is the richest source of starch.
Glycogen, a polymer of glucose, is known as animal starch and is present in liver. It functions as reserve carbohydrate in animals.

Properties of Starch : Starch is a white, amorphous powder with no odour and taste. It is insoluble in water. Soluble starch is prepared by heating ordinary starch with 10% HCl for 24 hours and then precipitating with alcohol.

Hydrolysis – When boiled with dilute mineral acids, it is first converted into dextrin and finally into glucose.

$$(C_6H_{10}O_5)_n \xrightarrow[\Delta]{\text{Dil. acid}} (C_6H_{10}O_5)_n \xrightarrow{\text{dil. Acid}} nC_6H_{12}O_6$$

Dextrin Glucose

Hydrolysis of starch with diastase, an enzyme gives maltose (a disaccharide).

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow[\text{(enzyme)}]{\text{Diastase}} nC_{12}H_{22}O_{11}\,\text{(Maltose)}$$

Action with iodine & Starch gives blue colour with iodine. The blue colour disappears on heating but reappears on cooling. Amylose gives blue colour whereas amylopectin gives brown colour with iodine.

Uses of Starch :

(i) In the manufacture of glucose, dextrin and adhesives.
(ii) For preparing ethyl alcohol.
(iii) As a laboratory reagent, an indicator for iodine titrations.
(iv) For sizing paper, textiles, etc.
(v) Starch is the main source of Carbohydrate. So, it is used as food in the form of bread, rice, potatoes, etc.
(vi) In laundry for stiffening cotton.

CELLULOSE, $(C_6H_{10}O_5)_n$:

It is the main constituent of the cell-wall of plants. The main source of cellulose are cotton and wood. Cellulose is most abundant carbohydrate in nature. Cellulose have β-glycosidic linkage between β-glucose units. It forms useful products like gun cotton cellulose acetate, rayon etc.

Properties of Cellulose :

(i) Cellulose is a white, amorphous, tasteless, fibrous substance, insoluble in water and organic solvents. It dissolves in a solution of cupric hydroxide in ammonia $[Cu(NH_3)_4](OH)_2$ **(Schweitzer's reagent)** from which acids, alcohols or salts precipitate it. This property is used in the manufacture of artificial silk (rayon, cupra silk).

(ii) Hydrolysis – On boiling with dilute acids, cellulose is completely hydrolysed to give β–glucose.

$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow[\Delta]{\text{Dil. acid}} nC_6H_{12}O_6$$

Cellulose glucose

Cattle and other ruminants have enzyme cellulase which hydrolyses cellulose to glucose. Hence, these animals can digest cellulose. Men cannot digest cellulose due to the lack of cellulase in their digestive system.

(iii) Cellulose when treated with conc. HNO_3 yields cellulose trinitrate. Its acetylation with acetic anhydride forms cellulose triacetate, thus showing the presence of three – OH groups per glucose unit.

Industrial applications of cellulose & In the manufacture of paper, artificial silk (rayon), explosives, etc. Gun cotton is cellulose trinitrate. It is a powerful explosive. It used for making smokeless powder or **cordite** which is a mixture of cellulose trinitrate, nitroglycerine and vaseline.

Blasting gelatin is a mixture of nitroglycerine and 70% gun cotton. Cellulose acetate is used for making non-inflammable photographic and motion picture films, non-shatterable glass and varnishes.

TRY IT YOURSELF-1

Q.1 Which of the following statement is incorrect for maltose–
(A) It is disaccharide
(B) It undergoes mutarotation
(C) It is a reducing sugar
(D) It does not have hemiacetal group.

Q.2 Glucose $\xrightarrow[\text{(ii) P/HI}]{\text{(i) HCN/H}_3\text{O}^{\oplus}}$ P ; P is –
(A) n-heptanoic acid (B) 2-methyl hexanoic acid
(C) n-heptane (D) 2-methyl hexane

Q.3 Same osazone derivative is obtained in case of D-glucose, D-Mannose and D-Fructose due –
(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 same configuration at C-3, C-4, C-5 and C-6 but different consitution and configuration at C-1 and C-2 which becomes identical by osazone formation.

Q.4 Glycogen on hydrolysis gives –
(A) Lactose and Glucose (B) Only Glucose
(C) Glucose and Fructose (D) Glucose and Maltose

Q.5 The colour of the precipitate formed when a reducing sugar is heated with Fehling solution is –
(A) Brown (B) Red
(C) Blue (D) Green

Q.6 Hydrolysis of lactose with dilute acid yield
(A) Equimolar mixture of D-glucose and D-glucose.
(B) Equimolar mixture of D-glucose and D-galactose.
(C) Equimolar mixture of D-glucose and D-fructose.
(D) Equimolar mixture of D-galactose and D-galactose.

Q.7 The letter D in D-glucose signifies –
(A) Dextro rotatory (B) Mode of synthesis
(C) Its configuration (D) Its dimagnetic nature

Q.8 Which of the following compounds can reduce Tollen's reagent ?

I. Sucrose II. Glucose
III. Fructose IV. Maltose
(A) I, II, III & IV (B) II only
(C) II & IV (D) II, III & IV

Q.9 α-D-glucose and β-D-glucose are –

(A) Epimers (B) Structural isomers
(C) Enantiomers (D) Diasteromers

Q.10 Which of the following compounds is formed by condenstaion of α-D-glucose units ?

(A) Sucrose (B) Maltose
(C) Lactose (D) Cellulose

ANSWERS

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

PROTEINS

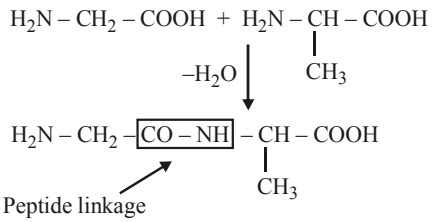
The word 'protein' was first of all given by Mulder. These are complex nitrogenous, organic compounds found in the protoplasm of all living cells. These are essential constituents of all the living cells.

Biological Importance of Proteins :

(i) Proteins are required for repairing the wear and tear of tissues.
(ii) Some proteins act as hormones such as insulin, oxytocin vasopressin, glutathione, etc.
(iii) All enzymes are proteins which catalyze the physiological reactions.
(iv) Proteins function as biological structural materials. For example, hair, nails, etc.
(v) Haemoglobin, the oxygen transporter which is a red coloured pigment in blood is a protein.
(vi) Antibodies in blood which provide resistance to diseases are proteins.
(vii) Nucleoproteins are the molecules of life. They are the important constituents of genes which transmit genetic messages in cell division.

Structure of Proteins :

Proteins are built up of a large number of α-amino acid molecules interlocked by elimination of water between NH_2 of one acid molecule and COOH of the other to form an amide like linkage.



Glycylalanine (Gly-Ala)

The product is a peptide and the grouping – CO – NH – is called a peptide linkage.

Peptides are further designated as di-, tri- and tetrapeptide according as they contain two/three or four amino acid molecules joined together in this fashion. In general, they are referred as polypeptides.

A polypeptide with more than hundred amino acid residues, having molecular mass higher than 10,000 u is called a protein.

Classification of Proteins %

Simple proteins & These yield α-amino acids only on complete hydrolysis.

Conjugated proteins & They produce a mixture of α-amino acids and a non-protein part (prosthetic group) on complete hydrolysis. For example Lipoproteins,chromoproteins,nucleoproteins,glycoproteins are conjugated proteins.

Derived proteins & Derived proteins are the intermediate products of hydrolysis of proteins.

Structure of Proteins % These are the condensation polymers of α-amino acids joined together through peptide (–CONH) bonds.

Primary structure : It refers to the sequence in which the various amino acids present in a protein are linked to one another in a polypeptide chain.

Change in the sequence of amino acids drastically changes the properties of protein. In haemoglobin change in just one amino acid unit causes sickel cell anemia.

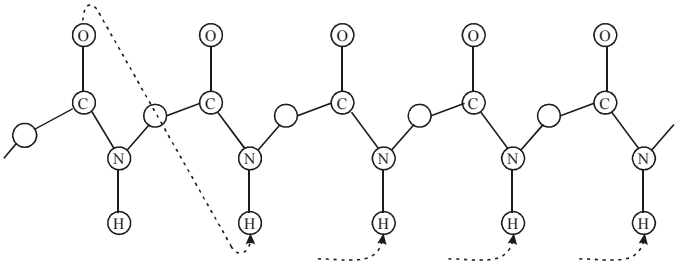
Normal haemoglobin →

Val – His – Leu – Thr – Pro – Glu

Sickel sell haemoglobin →

Val – His – Leu – Thr – Pro Val

Secondary structure & It refers to the formation of helical structure of proteins. The α or β–helical structure is stabilized by hydrogen bonds.



Secondary structure of Protein Molecules

Tertiary sturcture: It refers to the three dimensional structure of proteins. It includes bending and folding of long polypeptide chains. This structure is stabilized by H-bond, ionic bonds, etc.

Quaternary structure of proteins: Some of the proteins are composed of two or more polypeptide chains referred to as sub-units. The spatial arrangement of these subunits with respect to each other is known as quaternary structure.

Denaturation of Proteins : Protein found in a biological system with a unique three-dimensional structure and biological activity is called a native protein. When a protein in its native form, is subjected to physical change like change in temperature or chemical change like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity. This is called denaturation of protein. During denaturation 2° and 3° structures are destroyed but 1° structure remains intact.

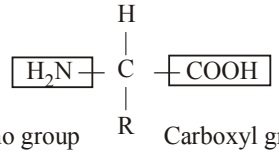
Example : The coagulation of egg white on boiling is a common example of denaturation. Another example is curdling of milk which is caused due to the formation of lactic acid by the bacteria present in milk.

AMINO ACIDS

Amino acids are the bifunctional organic compounds containing $-NH_2$ and –COOH groups. α–Amino acids are the building blocks of almost all the proteins. Proteins are linear condensation polymers of α–amino acids.

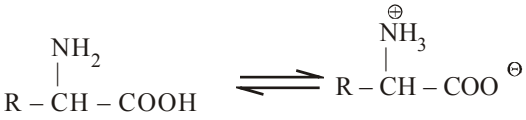
There are about 24 natural amino acids known.

Amino acid :



Non-essential amino acids : Human body can synthesize ten amino acids and hence they are called nonessential amino acids.

Essential amino acids : Amino acids which the human body cannot synthesize and are supplied in the human diet are called essential amino acids. Deficiency of these amino acids causes disease such as Kwashiorkor. All amino acids exist as Zwitter ion.



The dipolar structure is commonly known as Zwitter ion. In acidic medium, amino acids exist as cation while in alkaline medium they form a –ve ion. The pH at which an amino acid does not migrate towards any electrode is called its isoelectric point (P_i). Different amino acids have different P_i. All amino acids except glycine ($NH_2 - CH_2 - COOH$) are optically active.

ENZYMES

These are biological catalysts produced by living cells. They catalyze various biological reactions. They are highly specific in their action. All the enzymes are conjugated proteins There is an optimum pH and temperature for the proper functioning of each enzyme. Some of the important reactions catalyzed by enzymes are given below.

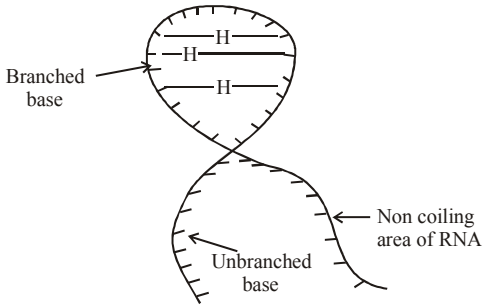
Enzymes	Reaction catalyzed
Zymase	Fermentation of glucose or fructose to ethyl alcohol
Invertase	Sucrose → glucose $ fructose
Maltase	Maltose → glucose $ glucose
Lactase	Lactose → glucose + galactose
Amylase	Amylum (starch) → glucose
Urease	Urea → $NH_3 + CO_2$
Pepsin	Proteins → α–Amino acids
Trypsin	Proteins → α–Amino acids
Nuclease	DNA/RNA → Nucleotides
Lipase	Oils or fats → glycerol $ fatty acids

NUCLEIC ACIDS

These are the prosthetic groups of nucleoproteins. These are natural biopolymers made of nucleotide units, i.e. these are polynucleotides. They are present in all the living cells. They direct the synthesis of proteins and are responsible for the transfer of genetic information, i.e., hereditary characteristics. Nucleic acids are of two types.

DNA or Deoxyribonucleic acid % The sugar unit present in these nucleic acids is 2-deoxyribose.

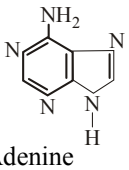
RNA or Ribonucleic acid % They contain ribose as the sugar unit. Nucleic acids are colourless, amorphous, compounds. The monomeric unit of nucleic acids are called nucleotides each nucleotide consists of three parts.



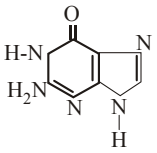
Structure of RNA

(a) Nitrogeneous bases – They are again of two types ;

Purine bases %

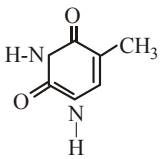


Adenine

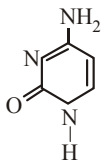


Guanine

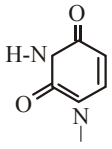
Pyrimidine bases :



Thymine



Cytosine



Uracil

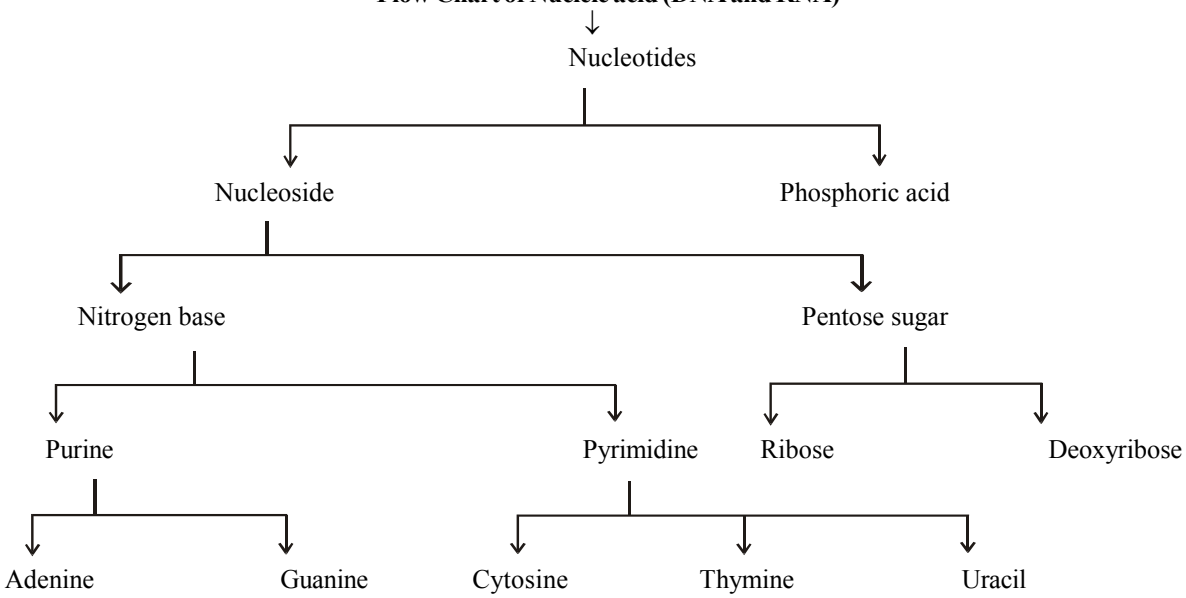
(b) Sugars : 2–Deoxy ribose (Present in DNA) and Ribose (Present in RNA)

(c) Phosphate unit : Nucleosides : A nucleoside is made up of a base unit and a sugar mostly.

For example% Adenine $ ribose = Adenosine
Guanine $ribose= Guanosine ; Cytosine $ ribose = Cytidine
Thymine $ ribose = Thymidine

Nucleotides : They are compounds of base, sugar and phosphate units. [Nucleotide = Nacleoside + phosphate unit]

Flow Chart of Nucleic acid (DNA and RNA)



Difference Between DNA and RNA

DNA	RNA
1. The pentose sugar is 2-deoxy ribose.	The pentose sugar is ribose.
2. DNA occurs in the nucleus of the cell.	RNA is found mainly in the cytoplasm of the cell.
3. The component bases of DNA are adenine, guanine,	The four component bases of RNA are adenine, guanine, cytosine and uracil.
4. DNA has double helical structure.	RNA has single helical structure.
5. It directs protein synthesis, stores and transfers genetic information.	It helps in protein synthesis.

Structure of DNA : In 1953 Waston and Crick proposed double stranded structure of DNA. The two polynucleotide chains of DNA molecule are twisted about a common axis. These chains run in opposite directions to form a right handed helix. The bases in the two chains are joined with each other by hydrogen bonds. Adenine forms pair with thymine and guanine with cytosine.

Replication : It is the property of a molecule to form its own duplicate copy. DNA possesses unique property to duplicate or replicate itself.

Transcription : It involves the copying of DNA base sequences into a complimentary RNA molecule known as messenger RNA.

Mutation : It is error in the base sequence in the DNA molecule. This chemical change in the DNA molecule leads to a protein synthesis having different amino acid sequence called mutation.

It may be caused by radiation, heat, chemicals or vireas etc.

VITAMINS (VITAL MINERALS)%

The organic compounds which are required in very small amounts and are necessary to maintain normal health, growth and nutrition are called vitamins. It should be noted that vitamins are not utilized in cell building or as energy source but they act as catalysts (co-enzymes) in biological processes. Their deficiency causes serious diseases. Vitamins are not synthesized in the body and hence should be supplied in diet i.e. they are essential dietary factors.

Classification of Vitamins :

(i) Fat soluble vitamins – These are vitamin A, D, E and K.

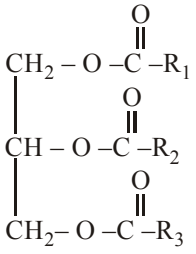
(ii) Water soluble vitamins – Vitamin B complex and vitamin C.

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

S. No.	Name of Vitamins	Sources	Deficiency diseases
1.	Vitamin A	Fish liver oil, carrots, butter and milk	Xerophthalmia (hardening of cornea of eye) Night blindness
2.	Vitamin B_1 (Thiamine)	Yeast, milk, green vegetables and ereals	Beri beri (loss of appetite, retarded growth)
3.	Vitamin B_2 (Riboflavin)	Milk, eggwhite, liver, kidney	Cheilosis (fissuring at corners of mouth and lips), digestive disorders and burning sensation of the skin.
4.	Vitamin B_6 (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 C (Ascorbic acid)	Citrus fruits, amla and green leafy vegetables	Scurvy (bleeding gums)
7.	Vitamin D	Exposure to unlight, fish and egg yolk	Rickets (bone deformities in children) and osteomalacia (soft bones and joint pain in adults)

OILS & FATS

Oils and fats are esters of glycerol with higher fatty acids, i.e., they are glycerol with higher fatty acids, i.e., they are glyceryl esters or glycerides. Oils, which are liquids at ordinary temperatures, contain a large proportion of unsaturated acids. Fats which are solids at ordinary temperatures contain a large proportion of saturated acids. The acids present in glycerides are almost exclusively straight chain acids and always contain an even number of carbon atoms. The chief saturated fatty acids are lauric ($C_{12}H_{25}$–COOH), myristic ($C_{13}H_{27}$–COOH), palmitic ($C_{15}H_{31}$– COOH) and stearic ($C_{17}H_{35}$–COOH). The main unsaturated acids are oleic, ($C_{17}H_{33}$–COOH) linoleic ($C_{17}H_{31}$–COOH) and linolenic ($C_{17}H_{29}$–COOH) acids. Oils and fats are complex mixtures of mixed glycerides which are represented by the following formula:

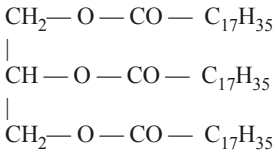


where R_1, R_2 and R_3 are different alkyl groups of high molecular weight

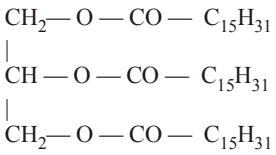
NOMENCLATURE OF GLYCERIDES

Glycerides are said to be simple when all the acids are the same and mixed when the acids are different. Glycerides are named according to the nature of the acids present. The suffix –ic of the common name of the acid being changed into –in. For example :

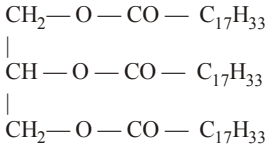
Simple Glycesides :



Tristearin

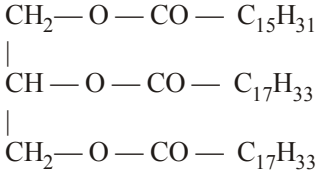


Tripalmitin



Triolein

Mixed Glyceride :

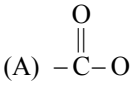


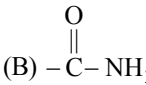
Palmitodiolein

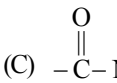
TRY IT YOURSELF-2

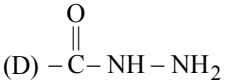
Q.1 Which compound can exist in a dipolar (Zwitter ion) state
(A) $C_6H_5CH_2CH(N=CH_2)COOH$
(B) $(CH_3)_2CH.CH(NH_2)COOH$
(C) $C_6H_5CONHCH_2COOH$
(D) $HOOC.CH_2CH_2COCOOH$

Q.2 Peptide linkage is –

(A) 

(B) 

(C) 

(D) 

Q.3 Which of the following α-aminoacids is not optically active
(A) Alanine (B) Glycine
(C) Phenylalanine (D) All are optically active

Q.4 The name of the dipeptide

(A) Glycyl glycine (B) Glycyl alanine
(C) Glycine alanine (D) Alanyl glycine

Q.5 Which of the following is a test for proteins ?
(A) Molisch's test (B) Beilstein test
(C) Biuret test (D) Bendict's test

Q.6 At isoelectric point, the amino acid has
(A) Least viscosity (B) Max. surface tension
(C) Maximum solubility (D) All of these

Q.7 α-helix refers to –
(A) Primary structure of proteins
(B) Secondary structure of proteins
(C) Tertiary structure of proteins
(D) Quaternary structure of proteins

Q.8 Which of the following is conjugated proteins –
(A) Alanine (B) Nucleic acids
(C) Glutenins (D) Peptones

Q.9 Oils and fats are esters of higher fatty acids with
(A) Ethanol (B) Glycol
(C) Glycerol (D) Methanol

Q.10 Vitamin B is known as –
(A) Ascorbic acid (B) Carotenoids
(C) Thiamine (D) Phyridoxine

Q.11 Which of the following if taken excessively can accumulate in body and cause toxicity ?
(A) Vitamin C (B) Vitamin D
(C) Vitamin B_2 (D) Vitamin K

ANSWERS

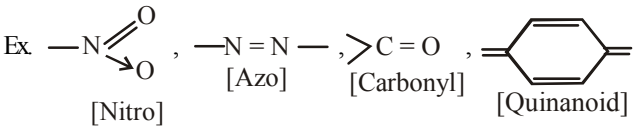
(1) (B) **(2)** (C) **(3)** (B)
(4) (D) **(5)** (C) **(6)** (A)
(7) (B) **(8)** (B) **(9)** (C)
(10) (C) **(11)** (B)

CHEMISTRY IN ACTION

1. DYES : Dyes are those coloured compounds that can be firmly fixed to the febrics by chemical or physical bonding.

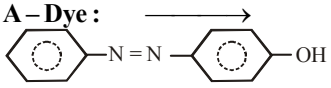
Exhibition of Colours : The fundamental in respect of colour of dyes is its ability to absorb some wave lengths of visible region of spectrum. The part of light which is reflected back gives the colour of the dye i.e., complementary to the colour absorbed.

Chromophores and auxochromes : An organic compound appears coloured due to the presence of certain unsaturated groups called chromophores.

Ex. 

The compounds containing chromophore group are called chromogens. The colour intensity increases with the number of chromophores or the degree of conjugation. Some groups, which are not chromophores by themselves but depend on the colour of the chromogen and are called auxochromes.

Acidic auxochromes –OH, $-SO_3H$, –COOH
Basic auxochromes $-NH_2$, –NHR, $-NR_2$

A – Dye : 

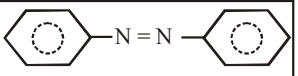
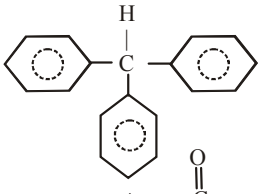
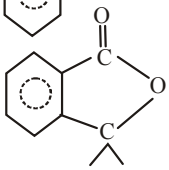
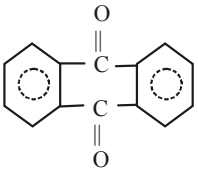
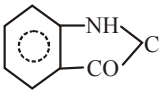
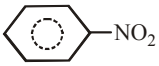
(p-Hydroxyazobenzene)

Ph – N = N – Ph ⟶ Chromogen
– N = N – ⟶ Chromophore
– OH ⟶ Auxochrome

CLASSIFICATION OF DYES

(I) Classification based on structure of their molecule
(II) Classification based on their use in the dye industry.

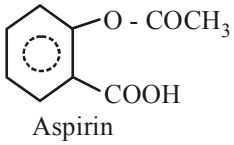
Classification based on structure :
Classification based on the special structural unit present in the structural formula of dyes is called chemical classification

S.No.	Class of Dye	Structural unit
1.	Azo dye	
2.	Triphenyl methane dye	
3.	Phthalein dye	
4.	Anthraquinone dye	
5.	Indigo dye	
6.	Nitro dye	

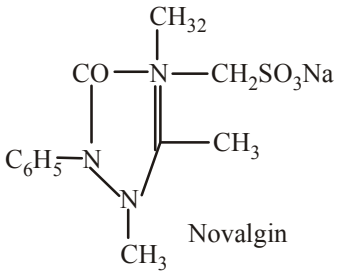
DRUGS

Chemical substance which are used for the treatment of disease and for reducing suffering from pain are referred to as medicines or drugs.

Analgesics : Analgesics are used as pain–killer. Aspirin is an important analgesic. Some other analgesics are novalgin, butazolidine, brufane, etc.

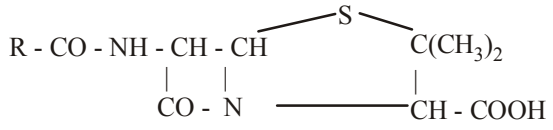


Aspirin



Novalgin

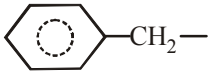
Antibiotics : Antibiotics are the compounds which are prepared by microorganisms and which restrict growth of the other microorganisms or destroy them. Alexander fleming first discovered the antibiotic medicine penicillin from penicillium notatum fungi.



Penicillin

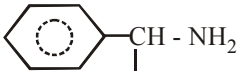
Penicillin is an effective drug for pneumonia, bronchitis, sore throat, etc.

Note : In the structure of pencillin R assigns different names to pencillin.

Penicillin – G 

Penicillin – F $R = -CH_2-CH=CH-CH_2-CH_3$

Penicillin – K $R = -(CH_2)_6-CH_3$

Ampicillin 

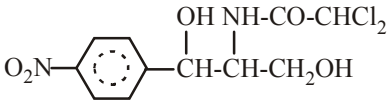
Ampicillin is the semisynthetic modification of penicillin Penicillin has a narrow spectrum action because Gram positive bacterial infection is cured by penicillin.

Broad spectrum antibiotics :

Broad spectrum antibiotics are medicines effective against several different types of harmful micro–organisms. Tetracycline, chloramphenicol etc.

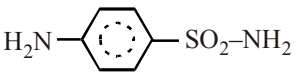
Streptomycin is used for the treatment of tuberculosis.

Chloramphenicol is given orally in case of typhoid, dysentery, urinary infection, meningitis, pneumonia etc.



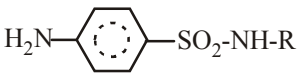
Chloramphenicol

Sulpha drugs posses great antibacterial powers and act against microorganism in the same way as antibiotics. These are a group of drugs which are derivatives of sulfanilamide.



Sulphanilamide

The general formula sulpha drugs is



Depending upon the nature of R, the sulpha drugs are

Sulphadiazine 

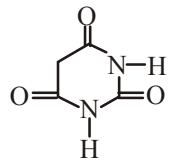
Sulphaguanidine $R = -C(=NH)-NH_2$

Sulphapyridine 

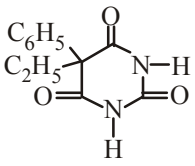
Antipyretics : Antipyretics are the compounds which are used for the purpose of reducing fever (lowering the body temperature to the normal). The most common antipyretics are, aspirin, antipyrine, phenacetin and paracetamol. Their administration (taking these drugs) often leads to perspiration.

Tranquillisers : These are the psycho–therapeutic drugs (meant to cure mental diseases). Tranquilizers act on the central nervous system and induce sleep. Obviously these drugs control the emotional distress of the patients. Since patient becomes habitual of these drugs. Therefore, they should not be administered without prescription.

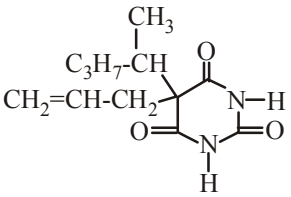
Barbituric acid, luminal and seconal are common tranquilizers.



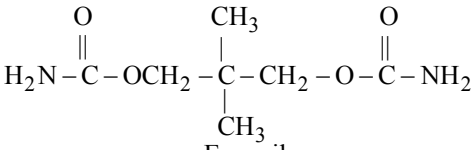
Barbituric acid



Luminal

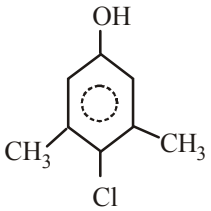


Seconal

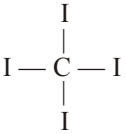


Equanil

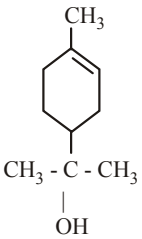
Antiseptics and Disinfectants : Antiseptics are the compounds, which kill microorganisms or restrict their growth. In order to destroy bed smell generated by bacteria, they are also mixed in toothpaste, toothpowder, mouthwash, soap, etc. Chlorine, iodine, and sulphurdioxide are important inorganic antiseptics. Disinfectant compounds destroy microorganisms, but their use on biological tissue is not safe. Therefore they are used to disinfect inanimate things. Dettol is an important domestic disinfectant and antiseptic. Its main components are chloroxylenol and terpeneol. Iodoform is also an antiseptic and disinfectant compound.



Chloroxylenol



Iodoform



Terpeneol

Ex. (1) 0.2% Phenol – Antiseptic
1% Phenol – Disinfectant
(2) Phenyl, B.H.C. and D.D.T. are also disinfectants

ROCKET PROPELLANTS

Mixture of fuel and appropriate oxidisers used in the propulsion of rockets are called rocket propellants.

Classification :

Solid propellants. Liquid propellants

Hybrid propellants

(1) Solid propellants :

Two types of solid propellants are:

(i) Composite propellants

(ii) Double base propellants

(i) Composite propellants : Composite propellant is made up of Fuel Oxidiser and Additives

Fuel : Polyurethane or polybutadiene is used as a fuel.

Oxidiser : Ammonium perchlorate is used as oxidiser.

Additive : Aluminium or magnesium (finely divided form) is used as additive.

(ii) Double base propellant : Nitrocellulose gels in nitro-glycerine sets as a solid mass acts as a double base propellant.

Note : Main difficulty with the solid propellant is that once ignited these will burn with pre-determined rate, and do not have the start and stop capability.

(2) Liquid propellants : Two types of liquid propellants are (i) Monopropellants (ii) Biliquid propellants

(i) Monopropellants : Monopropellants is a single chemical compound which acts both as a fuel and oxidiser.

Example : Hydrazine, methyl nitrate, notyromethane and hydrogen peroxide.

(ii) Biliquid propellants : Biliquid propellants possess both the fuel as well as oxidiser as liquids.

Example : Fuel : Kerosene, alcohol, hydrazine, monomethylhydrazine. (MMH), unsymmetrical dimethyl hydrazine (UDMH), liquid hydrogen etc.

Oxidiser : N_2O_4, O_2, HNO_3 etc.

Note : liquid propellants give higher thrust as compared to solid propellants. Further the flow of the liquid propellant can e regularated as such rate of combustion can be easily controlled.

(3) Hybrid propellants : Hybrid propellants are made of solid fuel and liquid oxidiser.

Example : Solid fuel — acrylic rubber

Liquid oxidiser — liquid N_2O_4

CHEMICALS IN FOOD

1. Chemical Preservatives : Some chemical substances which are added to food materials to prevent their spoilage are known as chemical preservatives. In our country, two chemical preservatives which are permitted for use are :

(i) sodium benzoate (C_6H_5COONa).

(ii) potassium metabisulphite ($K_2S_2O_5$).

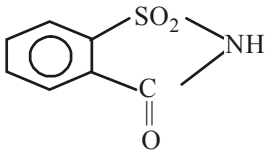
Benzoic acid : Benzoic acid or its sodium salt, sodium benzoate is commonly used for the preservation of food materials.

In some countries their use is restricted.

2. Synthetic Sweeteners : Synthetic sweeteners are hundred times more sweet than normal sugar.

Example :

(i) Saccharin : Used in place of sugar, it is 400 times more sweet than sugar. It's used for diabetic patients.



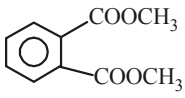
Saccharin

(ii) Sodium Saccharine : It is also used in place of sugar, it is 500 times more sweet than sugar.

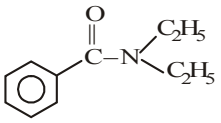
3. Antioxidation for food products : Some chemical substances are used for food substances, which are called antioxidants, some examples are (i) Systen : This is butyl hydroxy anisol (ii) 2-6, Ditertiary butyl p- cresol

INSECT REPELLANTS

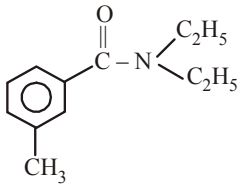
Insect repellants keep insects away from the host which may be human being or some pet animal. These are some repellants available in the market.



Dimethyl phthalate
(Good mosquito repellant)



N, N-Diethyl benzamide



N, N-Diethyl-meta-toluamide
(Deet)

CERAMICS

In general ceramics are inorganic, non-metallic, covalent network solids that can be made into a paste and shaped at normal temperatures which when fired at high temperatures gain strength. Clays, aluminium oxide (Al_2O_3), silicon nitride (Si_3N_4), silicon carbide (SiC) and crystalline and amarphous silicon dioxide (SiO_2) are some examples of this class of materials.

The major groups of the ceramic industry are :

1. Structural clay products e.g. brick, tile, terra cotta.
2. Portland cement.
3. Glass products.
4. Aluminium silicate fibres and ceramic foams.
5. Refractory materials e.g. alumina, magnesia.

Ceramics are lighter, stiffer and much more resistant to corrosion, as compared to metals. The strong directional bonding make them brittle. On the contrary non-directional bonds of metals allows the atoms to reposition and metal may bend or dent but not generally break.

Ceramics can be broadly classified into two categories :

(i) Silicate ceramics : Bricks, tiles, terra-cotta, dinnerware, glass, cement are all examples of silicate ceramics.

(ii) Non-silicate ceramics : Non-silicate ceramics can be further of two types : Oxide ceramics and non-oxide ceramics. Aluminia (Al_2O_3) magnesia (MgO) and beryllia (Be_2O_3) are examples of oxide non silicate ceramics.

Silicon carbide (SiC), silicon nitride (Si_3N_4), boron nitride (BN) and boron carbide (B_4C) are some examples of non-oxide, non-silicate ceramics.

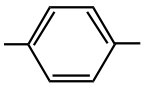
DETERGENTS

The synthetic detergents, soapless detergents, soapless soaps or syndets are substitute of soaps. Unlike soaps, they are derived from purely synthetic chemicals rather than from chemicals obtained form natural sources like oils fats. However, like soaps they contain both hydrophilic (water-soluble) and hydrophobic (oil-soluble) parts. Synthetic detergents are mainly of two types.

1. . . . . . **%** These are the half esters of an inorganic acid (H_2SO_4) rather than an organic acid and a higher primary alcohol, e.g. lauryl alcohol ($C_{12}H_{25}OH$). Sodium lauryl sulphate is the most important detergent of this type.

Ex. $CH_3(CH_2)_{10}CH_2OSO_2O^-Na^+$ sodium lauryl sulphate

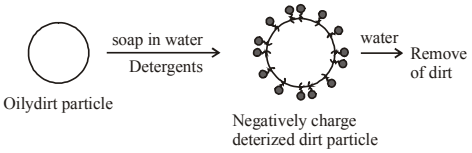
2. Sodium alkyl aryl sulphates % These are the sodium salts of long chain (linear) alkyl substituted benzene sulphonic acids (LAB) and are most widely used. The most common is sodium dodecylbenzene sulphate.

Ex. $CH_3(CH_2)_{10}CH_2$  $SO_2O^-Na^+$

Since in these detergents, the active portion is negatively charged, these are commonly known as anionic detergents.

Activity of detergents :

There two parts in detergents - one is long chain hydrocarbon part and other is ionic part. Hydrocarbon part is soluble in oils or greasy materials and insoluble in water while the ionic part is insoluble in oily or greasy substances and soluble in water. Detergents form colloidal solution in water, the hydrocarbon part of which forms big clusters with dirt particles and the ionic part goes into water. In this way on washing with water the whole part washes away with water.



SOAPS

1. Types of soaps:

(a) Hard soaps : These are obtained from cheap oils and fats using sodium hydroxide. These contains free alkali and are used for washing purposes.

(b) Soft soaps : These are obtained from good oils using potassium hydroxide. These do not contain free alkali and are used as toilet soaps, shaving cream, in shaving sticks (Pot. Sod. stearate) and shampoo.

(c) Transparent soaps : These are formed by dissolving toilet soaps in alcohol and evaporating the filtrate. They contain glycerol.

(d) Medicated soaps : Toilet soaps containing some medicinal important substance are called medicated soaps.

(e) Metallic soaps : These are soaps of metals other than sodium and potassium.

2. Manufacture of soap % Generally three processes are adopted for manufacture of soap. &

(a) The cold process : The soap of good quality is not obtained by this method as glycerol, alkali and oil remain with the soap. This is an expensive method. In this method oil is taken in an iron vessel and heated to about 50ºC. Calculated amount of sodium hydroxide is added to it slowly by stirring the mixture. The whole mixture is kept overnight which gets solidified and then is cut into pieces. Glycerol remains in the mixture in this method.

(b) The hot process : The following processes are involved in this method.

Saponification : A mixture of oil and alkali is heated in iron vessels by steam coils. The oil gets hydrolysed and a mixture of soap, glycerol, oil and water is obtained.

Salting out of soap : Saturated sodium chloride is added to the mixture obtained above. Due to common ion effect soap separates out and floats on surface of the solution. Soap is then separated from the solution and glycerol is recovered from the mother liquour. The mother liquour is known as spent-lye. Soap so obtained is washed with a small amount of water to remove the alkali. After some time it solidifies and then it is cut into pieces.

(c) Modern method : Glycerides of fatty acids are hydrolysed by water at higher temperatures in presence of catalyst to give glycerol and higher fatty acids. These are separated and fatty acids are reacted with NaOH or Na_2CO_3 at higher temperature to form its sodium salt. When lime or ZnO are used as catalyst, the method is known as Inter process and if sulphuric acid or aromatic sulphonic acids are used as catalyst it is called Twitchell method.

3. Cleansing Action of Soap % When soap is rubbed with the greasy surface of clothes with water, it forms an emulsion and the dirt particles separate out from the greasy surface. Soap forms colloidal solution with water, which separate the dirt particles by absorbing them and escape out on washing with water.

TRY IT YOURSELF-3

Q.1 The most useful classification of drugs for medicinal chemists is –
(A) on the basis of chemical structure.
(B) on the basis of drug action.
(C) on the basis of molecular targets.
(D) on the basis of pharmacological effect.

Q.2 Salvarsan is arsenic containing drug which was first used for the treatment of –
(A) syphilis (B) typhoid
(C) meningitis (D) dysentry

Q.3 A narrow spectrum antibiotic is active against –
(A) gram positive or gram negative bacteria.
(B) gram negative bacteria only.
(C) single organism or one disease.
(D) both gram positive and gram negative bacteria.

Q.4 The compound that causes general antidepressant action on the central nervous system belongs to the class of –
(A) analgesics (B) tranquilizers
(C) narcotic analgesics (D) antihistamines

Q.5 Compound which is added to soap to impart antiseptic properties is –
(A) sodium laurylsulphate
(B) sodium dodecylbenzenesulphonate
(C) rosin
(D) bithional

Q.6 Equanil is –
(A) artificial sweetener (B) tranquilizer
(C) antihistamine (D) antifertility drug

Q.7 Which of the following enhances leathering property of soap?
(A) Sodium carbonate
(B) Sodium rosinate
(C) Sodium stearate
(D) Trisodium phosphate

Q.8 Glycerol is added to soap. It functions –
(A) as a filler.
(B) to increase leathering.
(C) to prevent rapid drying.
(D) to make soap granules.

Q.9 Polyethyleneglycols are used in the preparation of which type of detergents?
(A) Cationic detergents (B) Anionic detergents
(C) Non-ionic detergents (D) Soaps

Q.10 Which of the following is not a target molecule for drug function in body?
(A) Carbohydrates (B) Lipids
(C) Vitamins (D) Proteins

ANSWERS

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

POLYMERS

The process of formation of a bigger molecule from many simpler molecules through mutual bonding is called polymerisation. The simpler molecules undergoing polymerisation are known as monomers and the bigger molecule formed is called a polymer.

$$n CH_2=CH_2 \longrightarrow [-CH_2-CH_2-]_n$$

Ethene (Monomer) Polythene (Polymer)

When more than one type of monomers undergo polymerisation, the process is called copolymerisation. Terylene and nylon–66 are members of copolymer family. The polymers found in nature are called biopolymers, for example, proteins, polysaccharides, nucleic acids (RNA and DNA) etc. These are composed of different types of monomeric units. The polymers having very high molecular weight are known as macromolecules.

CLASSIFICATION OF POLYMERS

[1] Classification based upon origin or source
[2] Classification based on structure
[3] Classification based on synthesis
[4] Classification based on intermolecular forces
[5] Classification based on the nature of repeating units

1. Classification based upon origin or source :
Polymers are classified into the following two categories on the basis of their source.
(I) Natural polymers (II) Synthetic polymers

(I) Natural Polymers : Found in nature and generally obtained from plants and animals. Main examples of natural polymer (Bipolymer) includes
1. Proteins (globin. insulin. etc.)
2. Polysaccharides (starch. cellulose. etc.)
3. Nucleic acids (RNA and DNA)
4. Natural rubber.

Proteins are regarded as copolymers of different types of amino acids. Starch and cellulose consist of chains of glucose units. Nucleic acid molecules consist of repeating nucleotide units. Each nucleotide is composed of the following three units.
1. Purine base or pyrimidine base.
2. Sugar 3. Phosphate

Natural rubber is a polymer of isoprene.

$$n CH_2=CH-\overset{\overset{CH_3}{|}}{C}=CH_2 \longrightarrow [-CH_2-CH=\overset{\overset{CH_3}{|}}{C}-CH_2-]_n$$

Isoprene (2-Methyl-1,3-butadiene) Polyisoprene (Natural rubber)

(II) Synthetic Polymers : Polymers synthesised in the laboratory are called synthetic polymer. These are very well known to us because of their great utility in our daily life. Some important examples are bakelite, nylon, terylene, P.V.C., polythene, polypropylene, polystyrene, polyvinyl alcohol, teflon, orlon, urea–formaldehyde resin, etc.

2. Classifications based on structure :

This classification of polymers is based upon how the monomeric units are linked together.

(i) Linear polymers : These are the polymers in which monomeric units are lined together to form long straight chains. Such polymers have high densities, high tensile strength and high melting points. Common examples of such type of polymers are polyethylene, nylons etc.

(ii) Branched chain polymers : In this type of polymers, the monomeric units are linked to constitute, long chains (called the main-chain). There are side chains of different lengths which constitute branches. They have low density, lower tensile strength and lower melting points. Amylopectin and glycogen are common examples of this type.

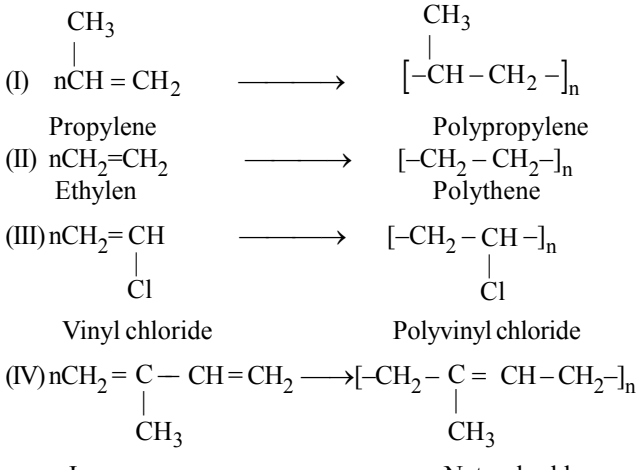
(iii) Cross-linked polymers : In this type of polymers, the monomeric units are linked together to constitute a three dimensional network. Cross-linked polymers are hard, rigid and brittle. Common examples of this type of polymers are bakelite, melamine formaldehyde resin, etc.

3. Classification Based on types of Synthesis :

Polymerisation reactions may take place in any of the following two ways.

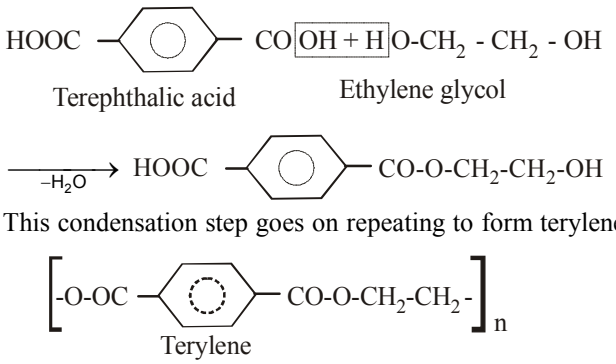
(I) Addition Polymerisation (II) Condensation Polymerisation

(I) Addition Polymerisation : In addition polymerisation, the unsaturated monomeric molecules undergo repeated addition reactions in the presence of catalysts like O_2, organic peroxides. Ziegler–Natta catalysts etc. to form polymeric molecules. Some examples of addition polymers are polythene from ethylene, polypropylene from propylene, polyisoprene from isoprene. etc.



Note : In addition Polymerisation a small amount of an organic peroxide is normally used as a free radical initiator. This converts the monomeric molecules to reactive free radicals, which join together to form a chain. A chain growth polymer is thus obtained. So Addition also called chain growth polymerisation.

(II) Condensation Polymerisation : Condensation polymerisation normally takes place by condensation of monomeric molecules. Each monomeric molecule has two reactive groups, which get removed in the form of small molecules, resulting in lenghtening of the chain or condensation. For example, terylene is formed by removal of water molecules from ethylene glycol and terephthalic acid molecules.



This condensation step goes on repeating to form terylene.

Note : In condensation Polymerisation, the monomeric molecules join each other step by step and not by chain process. Thus condensation is also known as step growth polymerisation.

Ex. (i) Terephthalic acid + ethylene glycol → Terylene + H_2O
(ii) Adipic acid + hexamethylenediamine → Nylon–66 + H_2O
(iii) Phenol + formaldehyde ⟶ Bakelite + H_2O
(iv) Urea + formaldehyde → Urea–formaldehyde resin + H_2O

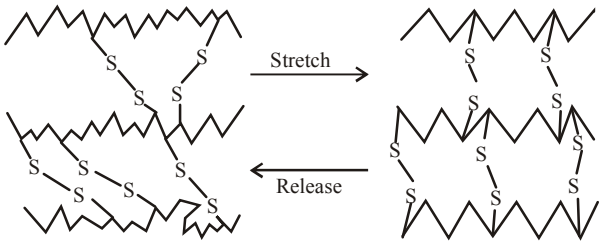
4. Classification Based on Intermolecular Forces :

Intermolecular forces are present between all types of molecules. However, these forces in macromolecules are much more pronounced due to cumulative effect of piling up, thus providing specific properties to polymers, such as toughness, tensile strength, elasticity etc. These are the properties which are responsible for certain specific uses of the polymers in everyday life.

Polymers can also be classified into the following four categories on the basis of the amount of intermolecular forces present.

(i) Elastomers : The molecules of elastic polymers or elastomers have very weak intermolecular forces and the polymeric chains also have cross–linking here and there. This is the reason why such polymers elongate on stretching and revert to their original shape on releasing. Vulcanised rubber is a very important example of the class of elastomers.

The polymeric chains in natural rubber remain coiled Such a polymer elongates on stretching, but cannot revert to its original shape on releasing, because of absence of cross-linkings between the chains. Therefore. there is a lack of elasticity. Such a rubber is heated with sulphur, which forms sulphur bridges at many sites between the polymeric chains. This process is known as vulcanisation and the rubber so obtained is called vulcanised rubber. Vulcanised rubber acquires elasticity due to sulphur bridges. i.e. besides flexibility, it has a capacity to maintain its shape. The elasticity in vulcanised rubber is shown in figure.



Part of vulcamsed rubber showing elasticity

(ii) Fibrous Polymers : Fibrous polymers have very high stretchability, because the polymeric chains in them are joined together by very strong intermolecular forces, like innumerable hydrogen bonds. Therefore. they are normaly crystalline in nature and have sharp melting points. Nylong-66 is an important example of this class.

(iii) Thermoplastic Polymers : Thermoplastic polymers readily become soft on heating and can thus be moulded into required shapes. Since, cross linking is absent, the strength of the intermolecular forces of their polymeric chains is between those of fibrous polymers and elastomers. Some important examples of this class of polymers are polyvinyl chloride, polythene, polypropylene, polystyrene etc.

(iv) Thermosetting Polymers : Thermosetting polymers are normally prepared by heating semiliquid polymers having lower molecular weights. Linkages establish between the polymer having lower molecular weights. These are infusible, because of sufficiently large number of cross bonds. They acquire a shape of three-dimensional network. important examples of this class of polymers are bakelite. ureaformaldehyde resin, etc.

5. Classification based on the nature of repeating units :

Homopolymer : When the polymer is formed from the same monomer it is called homopolymer.

Ex. Polyether, Polystyrene, Polyvinyl chloride etc.

Heteropolymer or co-polymer : More than one kind of monomers are used in the synthesis of polymer. Such polymers are called heteropolymer.

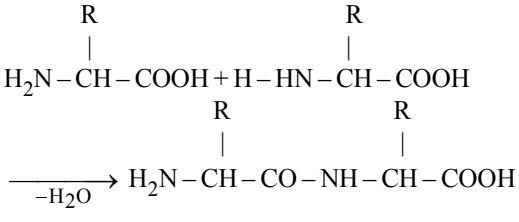
Ex. Buna-S (Styrene-butadiene rubber), Terylene, Nylone-66 etc.

SOME IMPORTANT NATURAL AND SYNTHETIC POLYMERS

1. Natural Polymer : Some important examples of naturally occurring polymers are polysaccharides, proteins, nucleic acids, and natural rubber.

Carbohydrate polymers have simple sugar units joined together. For example, starch and cellulose have repeating glucose units. Cellulose consists of unbranched chains and starch has branched chains of glucose units.

Proteins are formed by condensation copolymerisation of various α–amino acids on removal of water molecules with the formation of –CO–NH– linkages, called peptide bonds. Thus, proteins are chemically called polypeptides.



peptide bond

Nucleic acids are composed of many nucleotide units joined together. Each nucleotide unit consists of the following three subunits.

(i) Either purine or pyrimidine base

(ii) Either deoxyribose or ribose sugar

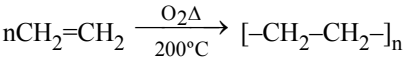
(iii) Inorganic phosphate

Natural rubber is regarded as formed by addition polymerisation of many isoprene units. Natural rubber is sticky and has very little capacity to maintain its shape, due to absence of cross–linkages between its polymeric chains.

2. Synthetic Addition Polymers :

(I) Polyolefin Polymers : Polyolefin polymers are prepared by addition polymerisation of hydrocarbon monomeric molecules having one double bond for example.

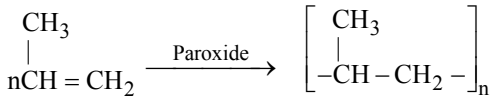
(i) Polythene or Polyethylene



Ethylene Polyethylene

Polyethylene is a translucent, flexible, tough and strong plastic, which is used in the preparation of packing films, moulded articles, pipes, tubes, bottles and electrical insulators.

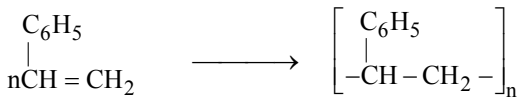
(ii) Polypropylene :



Propylene Polvpropylene

Polypropylene is a stronger plastic than polyethylene. It is also used like polythene in the manufacture of moulded articles.

(iii) Polystyrene :

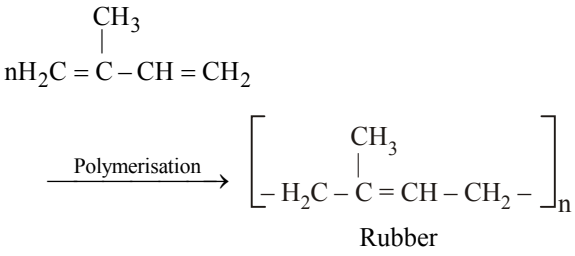


Styrene Polystyrene

Polystyrene is a colourless transparent, and extremely strong plastic. It is very largely used in refrigerators and air conditioners. It is also used in the manufacture of moulded articles.

(II) Polydiene Polymers : Polydiene polymers are prepared by addition polymerisation of 1, 3–dienes or their derivatives or by addition copolymerisation with some other unsaturated compounds, for example :

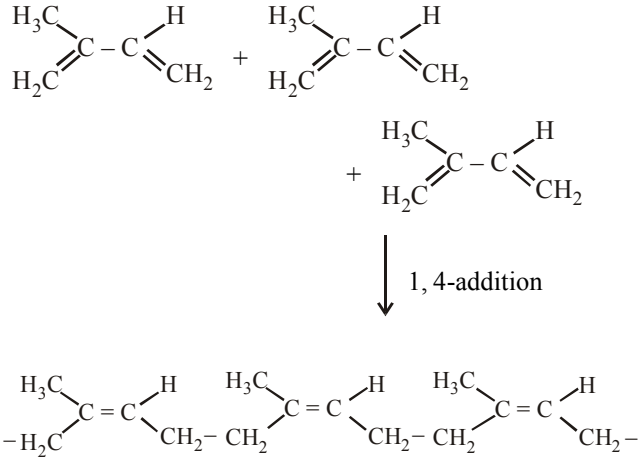
(i) Polyisoprene : Addition polymerisation of isoprene gives polyisoprene. This polymer resembles natural rubber in its properties.



Rubber

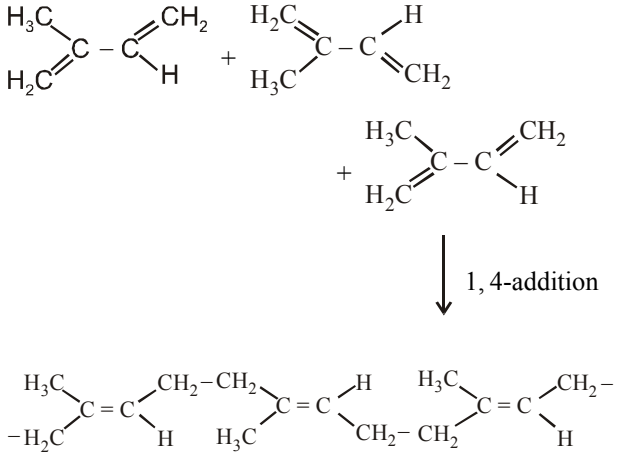
Natural rubber : Cis polyisoprene

All $-CH_2-CH_2-$ groups are on the one side (cis form)

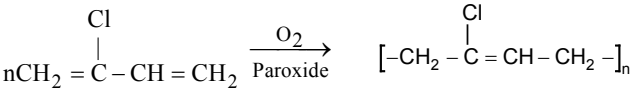


Gutta parcha : Trans polyisoprene

All $-CH_2-CH_2-$ groups are lying on the opposite direction



(ii) Neoprene : Neoprene rubber obtained by polymerisation of chloroprene, is an elastic polymer

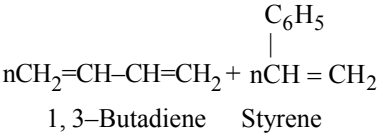


Chloroprene Neoprene rubber

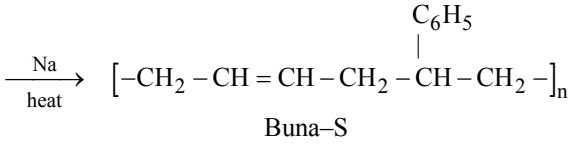
Neoprene is an extremely strong rubber which is used in the preparation of crepe soles of shoes, suits for divers, domestic articles, paints, adhesives, cement, etc.

(iii) Styrene–Butadiene Rubber :

Styrene–butadiene rubber (SBR) is also commonly known as Buna–S. It is prepared by copolymerisation of 1,3–butadiene (Bu) in the presence of sodium (Na) with styrene (S)



1, 3–Butadiene Styrene

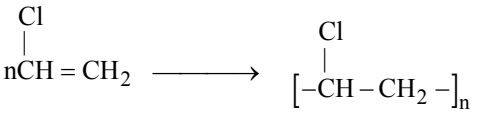


Buna–S

Buna–S is largely used in the preparation of tyres, as also in the preparation of rubber shoes, soles and heels of shoes belts, pipes etc.

(III) Polyhaloolefin Polymers : Polyhaloolefin polymers are prepared by addition polymerisation of halogenated alkenes, for example:

(i) Polyvinyl Chloride : Polyvinyl chloride is commonly known as PVC. is the most commonly used thermoplastic polymer. It is prepared by addition polymerisation of vinyl chloride.

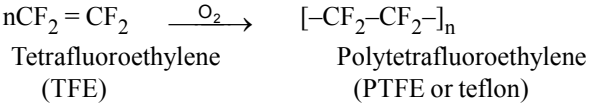


Vinyl chloride Polyvinyl chloride

P.V.C. is used in the preparation of many articles of great utility in everyday life, such as hose pipes and tubes, rain cloth, curtains, sacks, vinyl flooring, luggage, electrical insulating, coats, shoes, chappals etc.

(ii) Polytetrafluoroethylene :

Polytetrafluoroethylene is commonly called teflon. It is prepared by addition polymerisation of tetrafluoroethylene.

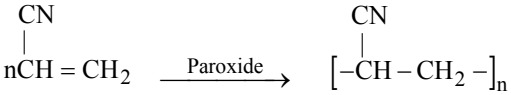


Tetrafluoroethylene (TFE) Polytetrafluoroethylene (PTFE or teflon)

Teflon is used in the preparation of many heat–resistant and chemical–resistant articles. for example. nonstick layer of kitchenware, gaskets, tapes, piston rings, etc.

(IV) Polyacrylates : Polyacrylates are addition polymers of acrylic monomeric molecules. For example.

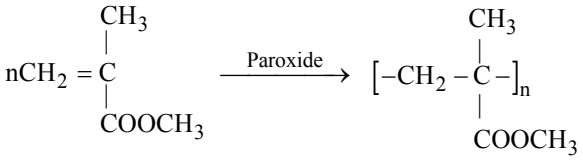
(i) Polyacrylonitrile : Polyacrylonitrile (PAN) is also known as acrilan and orlon. It is prepared by addition polymerisation of acrylonitrile (vinly cyanide).



Acrylonitrile Acrilan (PAN)

Acrilan is a synthetic fibre, which is used in the preparation of cloth, carpets, curtains, blankets (quilts), electrical insulators, etc.

(ii) Poly Methyl methacrylate : Poly methyl methacrylate abbreviated to PMMA. is prepared by addition polymerisation of methyl methacrylate



(PMMA)

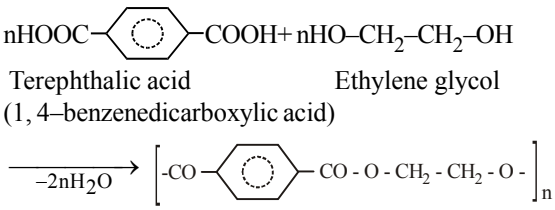
PMMA is a hard and transparent polymer. It is sold under the commercial names of leucite, perspes, plexiglass and acrylite. It is used in the preparation of aircraft window panes, lenses, buttons, brushes, parts of refrigerators, safety dresses etc.

3. Synthetic Condensation Polymers

(I) Polyester Polymers

Polyester polymers are prepared by condensation polymerisation of carboxylic acids and alcohols by the of ester bonding, for example :

(i) Terylene : Terylene is a very strong fibre synthesised by copolymerisation of terephthalic acid and ethylene glycol.



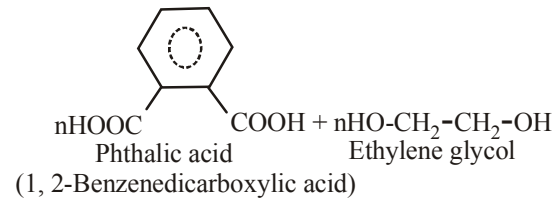
Terephthalic acid (1, 4–benzenedicarboxylic acid) Ethylene glycol

Terylene

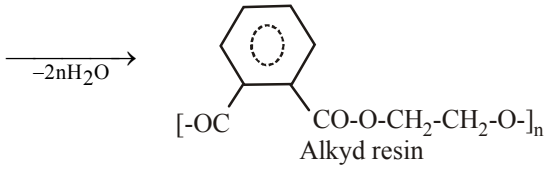
Terylene, also known as dacron, is a synthetic fibre, which is used for the preparation of cloth, belts,sails of boats etc.

(ii) Alkyd Resins :

Alkyd resins are synthesised by condensation copolymerisation of phthalic acid (or phthalic anhydride) and glycol (or glycerol)



Phthalic acid (1, 2-Benzenedicarboxylic acid) Ethylene glycol



Alkyd resin

Alkyd resins are also known as Glyptals. These are mainly used in the form of paints, varnishes,enamels, etc, for protection and decoration of metal surfaces.

(II) Polyamide Polymers : Polyamide polymer chains have amide linkages formed by removal of water molecules from COOH and NH_2 groups of monomeric molecules, for example :

(i) Nylon–66 : Nylon–66 is synthesised by condensation copolymerisation of adipic acid and hexamethylenediamine 66 is used because the monomers have 6 carbon atoms each.

$nHOOC–(CH_2)_4–COOH + nH–NH–(CH_2)_6–NH–H$

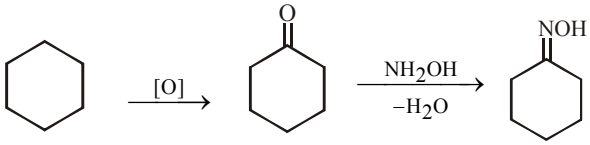
Adipic acid (Hexanedioic acid) Hexamethylenediamine (1, 6–Hexanediamine)

$\xrightarrow[523K]{-nH_2O}$ $[–CO–(CH_2)_4–CO–NH–(CH_2)_6–NH–]_n$

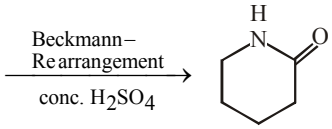
Nylon–66

Nylon–66 molecules consist of alternately repeating units of two monomers, each having six carbon atoms per molecule. It is used in the preparation of sheets, fibres for cloth weaving. bristles for brushes. etc.

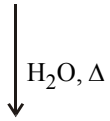
(ii) Nylon–6 : [Perlon] → It is synthesised by polymerisation of caprolectum. The reaction steps are -

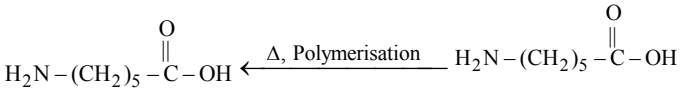


(Cyclohexane) (Cyclohexanone) (Cyclohexaneoxime)



(Caprolectum)



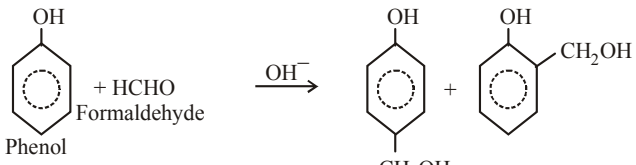


Nylon-6 (Amino caproic acid)

Nylon-6 is used in the preparation of fibres for cloth weaving, threads present in tyres, ropes etc.

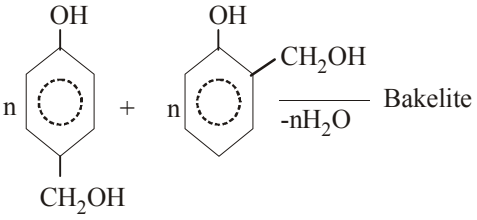
(III) Formaldehyde Polymers : Formaldehyde polymers (or formaldehyde resins) are synthesised by condensation polymerisation of a monomer, which is obtained by addition of an appropriate molecule on formaldehyde. For example

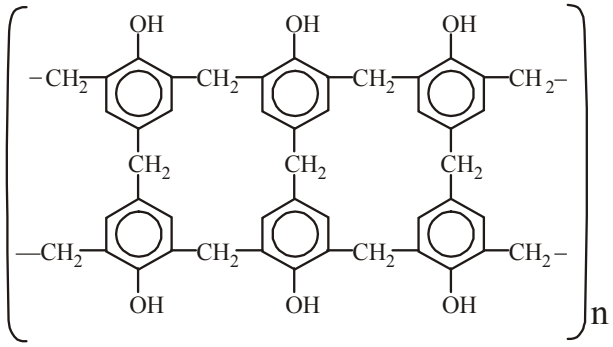
(i) Phenol–Formaldehyde Resin : Phenol adds on formaldehyde in the presence of an alkali catalyst to form a mixture of o– and p–hydroxybenzyl alcohols as intermediate products (Leaderer–Manasse reaction) These further react to undergo polymerisation to form phenolformaldehyde resin. The cross–linked polymer so obtained is known as bakelite.



Phenol + HCHO Formaldehyde

Hydroxybenzyl alcohols



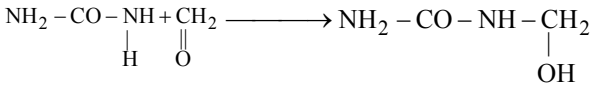


Bakelite

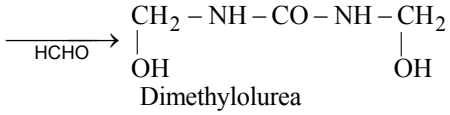
In bakelite, the polymeric chains are joined together by $-CH_2-$ bridges. Therefore, bakelite is a thermosetting polymer, which is widely used in the preparation of electrical appliances, gramophone records,formica, fountain pens, parts of machinery, combs etc.

(ii) Urea–Formaldehyde Resin

When urea and formaldehyde are heated in the presence of small amounts of pyridine or ammonia an adduct, methylolurea is first formed, followed by the formation of dimethylolurea.



Urea Formaldehyde Methylolurea

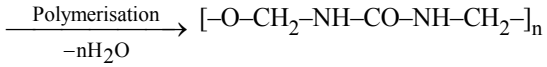


Dimethylolurea

Dimethylolurea is further subjected to condensation polymerisation to form bakelite or urea–formaldehyde resin.

$nHO-CH_2-NH-CO-NH-CH_2OH$

Dimethylolurea

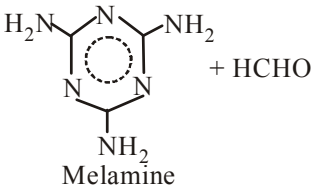


Urea–formaldehyde resin

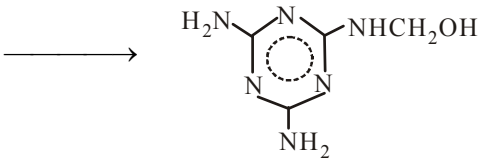
Urea–formaldehyde resin is used in the preparation of moulded articles, safely dresses, papers, adhesives etc.

(iii) Melamine–Formaldehyde Resin

Melamine and formaldehyde first react to form methylolmelamine as an intermediate product.

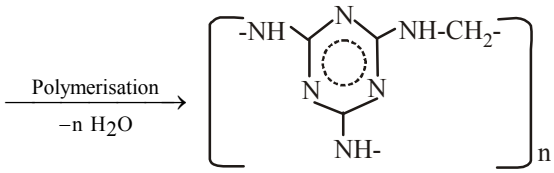


Melamine



Trimethylolmelamine molecules undergo condensation polymerisation to form melamine–formaldehyde resin. also called melmac polymer.

n Methylolmelamine

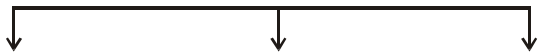


Melmac

Melmac polymer is used in the preparation of crockery, plastic wares and moulded articles, which are very strong.

MECHANISM OF POLYMERISATION :

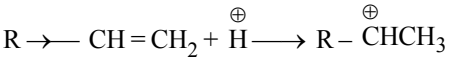
Mechanism of polymerisation



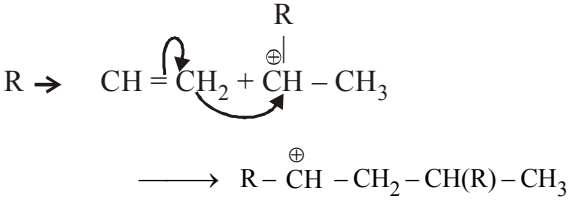
Acid-catalysed or cationic polymerisation	peroxide catalysed or free radical polymersation	base catalysed or anionic polymerisation

Acid catalysed or cationic polymerisation :

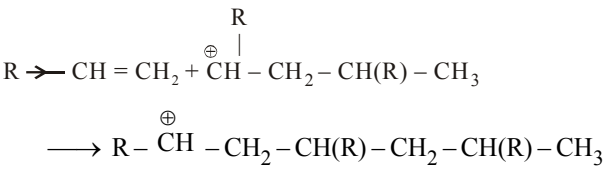
General mechanism is given as under :



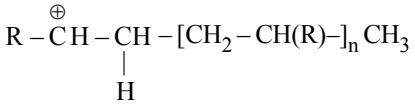
Dimerisation :

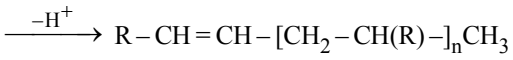


Trimerisation :



Ultimately a polymeric carbocation is formed. Which loses a proton and converts into neutral polymer molecule.

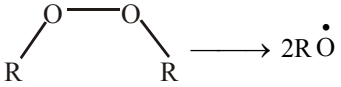




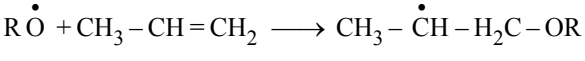
Peroxide catalysed or free radical polymerisation :

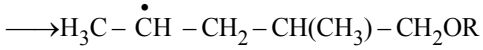
The mechanism is given as under.

Chain initiation step :

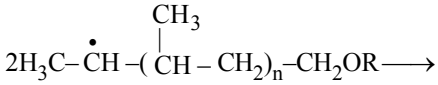


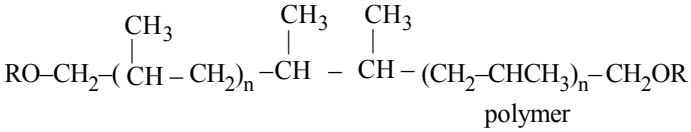
Chain propagation step :





Chain terminating step : Two polymeric free radicals combine to form neutral polymer molecule.

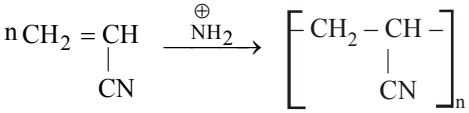




polymer

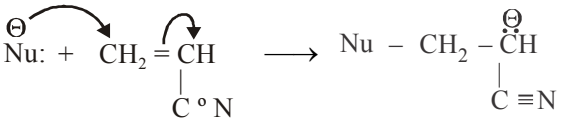
Base catalysed or anionic polymerisation :

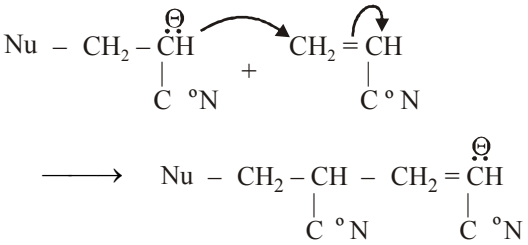
If an alkene group is associated with electron attracting group like (– CN, – Cl, – $OCOCH_3$ etc.) then polymerisation process is initiated by a base



polyacrylonitrile

The Amionic polymerisation of alkenes is quite difficult because the amionic or nucleophilic species are not attracted by the alkene and thus polarisation of the π-bond is very difficult.





(polymeric carbanion)

Some common examples of alkenes that undergo amionic polymerisation are Vinyl chloride, Acrylonitrile, methylmethacrylate, styrene etc.

Molecular weight of polymers :

There are two types of average molecular weight in case of polymers.

(a) $\bar{M}_n$ = Number average molecular weight

(b) $\bar{M}_w$ = Weight average molecular weight

(a) Number average molecular weight ($\bar{M}_n$)

$$\bar{M}_n = \frac{\text{Total weight of the molecules}}{\text{Total number of molecules}}$$

If :

n_1 molecules are there of mol. wt. M_1
n_2 molecules are there of mol. wt. M_2
n_3 molecules are there of mol. wt. M_3. Then

$$\bar{M}_n = \frac{n_1M_1 + n_2M_2 + n_3M_3 + - - -}{n_1 + n_2 + n_3 + - - -}$$

$$\bar{M}_n = \frac{\Sigma n_i M_i}{\Sigma n_i}$$

$\bar{M}_n$ is generally determined by osmetic pressure method.

(b) Weight average molecular weight ($\bar{M}_n$)

$$\bar{M}_w = \frac{w_1M_1 + w_2M_2 + w_3M_3 + - - -}{w_1 + w_2 + w_3 + - - -}$$

[weight (w) = no. of molecules (n) × molecular weight (M)]

Where : w_1 = weight of the molecules of mol. wt. M_1
w_2 = weight of the molecules of mol. wt. M_2
w_3 = weight of the molecules of mol. wt. M_3

$\bar{M}_w$ is generally determined by the light scattering method.

Ex : A sample contains equal number of molecules of molecular weight $M_1 = 10{,}000$ and $M_2 = 1{,}00{,}000$. For the above mixture find out $\bar{M}_n$ and $\bar{M}_w$

We have : Let $n_1 = n_2 = n$

$$\bar{M}_n = \frac{nM_1 + nM_2}{n + n} = \frac{M_1 + M_2}{2}$$

$$= \frac{10^4 + 10^5}{2} = \frac{11}{2} \times 10^4 = 55{,}000$$

$\therefore \quad \bar{M}_n = 55{,}000$

$$\therefore \quad \bar{M}_w = \frac{w_1M_1 + w_2M_2}{w_1 + w_2}$$

$$\left[\because n = \frac{w_1}{M_1} \quad \text{or} \quad w_1 = nM_1 \; ; n = \frac{w_2}{M_2} \quad w_2 = nM_2 \right]$$

$$\therefore \quad \bar{M}_w = \frac{nM_1^2 + nM_2^2}{nM_1 + nM_2} = \frac{M_1^2 + M_2^2}{M_1 + M_2}$$

$$= \frac{10^8 + 10^{10}}{10^4 + 10^5} = \frac{10^8 \times 101}{10^4 \times 11} = \frac{101}{11} \times 10^4 = 91{,}818$$

PDI (POLY DISPERSITY INDEX) :

The ratio of the $\bar{M}_w$ and $\bar{M}_n$ is called PDI. $\quad PDI = \frac{\bar{M}_w}{\bar{M}_n}$

In natural polymers, which are generally mono dispersed, the PDI is unity ($\bar{M}_w = \bar{M}_n$)

In synthetic polymers which are poly dispersed, PDI is greater than unity because $\bar{M}_w$ is always higher than $\bar{M}_n$.

USEFUL TIPS

* Addition polymers : Polyvinyl chloride, polythene.
  Condensation polymers : Terylene, Bakelite
* Monomers of -
  Hexamethylenediamine : $H_2N-(CH_2)_6-NH_2$
  Adipic acid : $HOOC-(CH_2)_4COOH$.
  Tetrafluoroethene : $F_2C=CF_2$
* Vulcanization of rubber is carried out by heating crude rubber in presence of sulphur or dipping it in a solution of S_2Cl_2 in CS_2. It has extensive cross linking.
* Vulcanization depends upon amount of sulphur used, temperature and duration of heating. The rubber can be hardened by increasing the amount of sulphur.
* Another name for natural rubber is cis,1-4-polyisoprene.
* Viscose rayon and acetate fibres are semi synthetic fibres.
* Nylon, dacron, orion are the examples of true synthetic fibres.
* Rayon was originally called artificial silk, but now it is the general name given to all artificial fibres derived from cellulose.
* Terylene is the British name of dacron.
* Orion is prepared by the polymerisation of acrylonitrile.
* Saran is a copolymer of vinilidene chloride and vinyl chloride.
* Teflon is polytetra fluorethylene, $(C_2F_4)n$.
* Dynel is a co-polymer of acrylonitrile and vinyl chloride.
* $nCH_2=CH_2 \xrightarrow[350\text{-}570\ K]{1000\text{-}2000atm} \underset{\text{Low density polythene (LDP)}}{-(CH_2-CH_2)-_n}$
* $nCH_2=CH_2 \xrightarrow[350\ K]{\text{Ziegler-natta catalyst}} \underset{\text{High density Polythene (HDP)}}{-(CH_2-CH_2)-_n}$
* The LDP has highly branched structure and formed by free radical mechanism.
* LDP is chemically inert tough but flexible and poor conductor of electricity hence used in insulation of electric wire, manufacturing of squeez bottles toys and flexible pipes.
* The HDP has less branching. It is characterised by relatively high tensile strength, toughness, chemically inert and used in manufacturing of containers, house wares, bottles, pipes .

TRY IT YOURSELF-4

Q.1 Which among the following is a branched chain polymer?
(A) Nylons (B) Polyesters
(C) Glycogens (D) Bakelite

Q.2 Which of the following type of forces are present in Nylon-66 ?
(A) Vander Waal's forces of attraction
(B) Hydrogen bonding
(C) Three dimensional network of bonds.
(D) None of these

Q.3 Which of the following is a natural polymer ?
(A) Polythene (B) Polysaccharides
(C) Nylon (D) Terylene

Q.4 Which of the following is an elastomer ?
(A) Vulcanized rubber (B) Dacron
(C) Polystyrene (D) Malamine

Q.5 Which of the following is not a semisynthetic polymer?
(A) cis-polyisoprene (B) Cellulose nitrate
(C) Cellulose acetate (D) Vulcanised rubber

Q.6 Which of the following statements is not true about low density polythene?
(A) Tough
(B) Hard
(C) Poor conductor of electricity
(D) Highly branched structure

Q.7 Which of the following polymers are used as fibre?
(A) Polytetrafluoroethane (B) Polychloroprene
(C) Nylon (D) Terylene

Q.8 Which of the following polymers, need atleast one diene monomer for their preparation?
(A) Dacron (B) Buna-S
(C) Neoprene (D) Novolac

Q.9 Which of the folloiwng are characteristics of thermosetting polymers?
(A) Heavily branched cross linked polymers.
(B) Linear slightly branched long chain molecules.
(C) Become infusible on moulding so cannot be reused.
(D) Soften on heating and harden on cooling, can be reused.

Q.10 Which of the following polymers are thermoplastic?
(A) Teflon (B) Natural rubber
(C) Neoprene (D) Polystyrene

ANSWERS

(1) (C) **(2)** (B) **(3)** (B) **(4)** (A)
(5) (A) **(6)** (C) **(7)** (CD) **(8)** (BC)
(9) (AC) **(10)** (AD)

QUESTION BANK

CHAPTER 13 : BIOMOLECULES, CHEMISTRY IN EVERYDAY LIFE & POLYMERS

EXERCISE - 1 [LEVEL-1]

Choose one correct response for each question.

PART 1 : CARBOHYDRATES

Q.1 Which of the following is a carbohydrate
(A) Leucine (B) Albumin
(C) Inulin (D) Maltase

Q.2 General formula for carbohydrates is
(A) $C_nH_{2n}O_{2n+2}$ (B) $C_x(H_2O)_{2x}$
(C) $C_x(H_2O)_y$ (D) None of these

Q.3 When sucrose is heated with conc. HNO_3 the product is
(A) Sucrose nitrate (B) Formic acid
(C) Oxalic acid (D) Citric acid

Q.4 Optical activity is shown by
(A) Glucose (B) Fructose
(C) Sucrose (D) All of these

Q.5 The disaccharide present in milk is
(A) Maltose (B) Lactose
(C) Sucrose (D) Cellobiose

Q.6 The charring of sugar, when treated with conc. H_2SO_4 is due to
(A) Oxidation (B) Reduction
(C) Dehydration (D) Hydrolysis

Q.7 Which among the following is the simplest sugar
(A) Glucose (B) Cellulose
(B) Starch (D) Glycogen

Q.8 In fructose, the possible optical isomers are
(A) 12 (B) 8
(C) 16 (D) 4

Q.9 What is the basic formula for starch ?
(A) $(C_6H_{12}O_6)_n$ (B) $(C_6H_{10}O_5)_n$
(C) $C_{12}H_{22}O_{11}$ (D) $(C_6H_{12}O_4)_n$

Q.10 Which of the following compounds is found abundantly in nature ?
(A) Fructose (B) Starch
(C) Glucose (D) Cellulose

Q.11 What are the hydrolysis products of sucrose ?
(A) Fructose + Fructose (B) Glucose + Glucose
(C) Glucose + Galactose (D) Glucose + Fructose

Q.12 The letter 'D' in carbohydrates signifies
(A) Dextrorotatory (B) Configuration
(C) Diamagnetic nature (D) Mode of synthesis

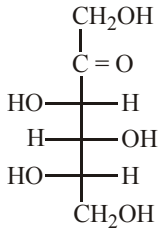
Q.13 Maltose is made up of
(A) Two α-D-glucose (B) Normal β-D-glucose
(C) α-and β-D-glucose (D) Fructose

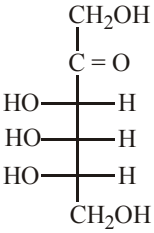
Q.14 Select the group in which the cane sugar, glucose and starch are classified.
(A) Carbohydrates (B) Proteins
(C) Nucleic acids (D) Vitamins

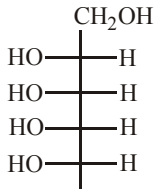
Q.15 Cellulose is a
(A) Hexapolysaccharide (B) Pentapolysaccharide
(C) Tripolysaccharide (D) None of these

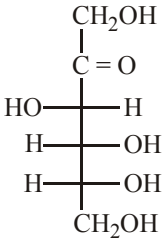
Q.16 Which of the following treatment will convert starch directly into glucose ?
(A) Heating with dilute H_2SO_4
(B) Fermentation by diastase
(C) Fermentation by zymase
(D) Heating with dilute NaOH

Q.17 Choose the structure of D-(–)-fructose.

(A)


(B)


(C)


(D)


PART 2 : PROTEINS

Q.18 The proteins which are insoluble in water are
(A) Fibrous proteins (B) Globular proteins
(C) Both (A) and (B) (D) None of these

Q.19 Irreversible precipitation of proteins is called
(A) Denaturation (B) Hydrolysis
(C) Rearrangement (D) Electrophoresis

Q.20 The proteins with a prosthetic group are called
(A) Pseudo proteins (B) Complex proteins
(C) Conjugated proteins (D) Polypeptides

Q.21 Proteins are hydrolysed by enzymes into
(A) Dicarboxylic acids (B) Hydroxy acids
(C) Amino acids (D) Aromatic acids

Q.22 Proteins when heated with conc. HNO_3 give a yellow colour. This is
(A) Oxidising test (B) Xanthoprotic test
(C) Hoppe's test (D) Acid-base test

Q.23 Proteins are built up of
(A) Dicarboxylic acids (B) Amino acids
(C) Alcohols (D) Hydroxy acids

Q.24 Which of the following foodstuffs contains nitrogen
(A) Carbohydrates (B) Fats
(C) Proteins (D) None of these

Q.25 Which of the following is not a classification of proteins
(A) Enzymes (B) Antibodies
(C) Antigens (D) Hormones

Q.26 Which statements about proteins is not true
(A) Amino acid residues join together to make a protein molecule.
(B) Proteins are polymers with formula $(C_6H_{10}O_5)_n$.
(C) Eggs are rich in protein.
(D) Pulses are good source of proteins.

Q.27 Globular proteins are present in
(A) Blood (B) Eggs
(C) Milk (D) All of these

Q.28 Secondary structure of protein refers to
(A) Sequence of amino acids in polypeptide chain
(B) Bonds between alternate polypeptide chains
(C) Folding patterns of polypeptide chain
(D) Bonding between NH_3^+ and COO^- of two peptides.

Q.29 Denaturation of protein leads to loss of its biological activity by
(A) Formation of amino acids.
(B) Loss of primary structure.
(C) Loss of both primary & secondary structure.
(D) Loss of both secondary & tertiary structures.

Q.30 Keratin, a structural protein is present in
(A) Hair (B) Wool
(C) Silk (D) All of these

Q.31 Primary structure of a protein is
(A) Sequence in which α-amino acids are linked to one another.
(B) Sequence in which amino acids of one polypeptide chain are joined to other chain.
(C) The folding patterns of polypeptide chains.
(D) The pattern in which the polypeptide chains are arranged.

PART 3 : ENZYMES

Q.32 Starch is converted into maltose by the –
(A) Maltase (B) Invertase
(C) Zymase (D) Diastase

Q.33 The enzyme which combines with non protein part to form a functional enzyme is:
(A) Holoenzyme (B) Prosthetic group
(C) Apoenzyme (D) None of these

Q.34 Incorrect statement is –
(A) All proteins are enzymes.
(B) All enzymes are biocatalysts.
(C) All enzymes are thermolabile.
(D) All enzymes are proteins.

Q.35 A nonprotein organic part attached firmly by a covalent linkage to the apoenzyme is called:
(A) activator (B) cofactor
(C) coenzyme (D) prosthetic group

Q.36 A biological catalyst is essentially
(A) An enzyme (B) A carbohydrate
(C) An amino acid (D) A nitrogen compound

Q.37 Enzymes are made up of
(A) Edible proteins
(B) Proteins with specific structure
(C) Nitrogen containing carbohydrates
(D) Carbohydrates.

PART 4 : VITAMINS

Q.38 Vegetable oils like wheat germ oil, sunflower oil, etc. are the good source of
(A) Vitamin K (B) Vitamin E
(C) Vitamin D (D) Vitamin A

Q.39 Vitamin B_1 is
(A) Riboflavin (B) Cobalamine
(C) Thiamine (D) Pyridoxine

Q.40 Which of the following vitamins is water soluble?
(A) Vitamin E (B) Vitamin D
(C) Riboflavin (D) Retinol

Q.41 Vitamin C must be supplied regularly in diet because
(A) It is water soluble hence excreted in urine and can't be stored in the body.
(B) It is fat soluble hence stored in the body and cannot be used on regular basis
(C) It is required in a large amount by the body hence supplied regularly.
(D) It is water soluble hence used by the body on daily basis and is to be supplied regularly.

Q.42 Which of the following is not produced by human body?
(A) Enzymes (B) Vitamins
(C) Proteins (D) Nucleic acid

Q.43 Which is a fat soluble vitamin ?
(A) Vitamin A (B) Vitamin B_6
(C) Vitamin C (D) Vitamin B_2

PART 5 : NUCLEIC ACIDS

Q.44 AGCT are nitrogenous bases of DNA. The pairing is:
(A) A–G, C–T (B) A–T, G–C
(C) A–C, G–T (D) A–T, G–T

Q.45 Which DNA molecule among the following will melt at lowest temperature?
(A) 5′-A-A-T-G-C-T-G-C-3′
3′-T-T-A-C-G-A-C-G-5′
(B) 5′-A-A-T-A-A-A-G-C-3′
3′-T-T-A-T-T-T-C-G-5′
(C) 5′-G-C-A-T-A-G-G-C-3′
3′-C-G-T-A-T-C-C-G-5′
(D) 5′– A-T-G-G-C-T-G-C-3′
3′-T-A-C-C-G-A-C-G-5′

Q.46 Hydrogen bonds between cytosine and guanine–
(A) 1 (B) 2
(C) 3 (D) 4

Q.47 Carbon atoms of the pentose sugar involved in phosphodiester bond formation in DNA and RNA are:
(A) C_1' & C_5' (B) C_2' & C_3'
(C) C_4' & C_5' (D) C_3' & C_5'

Q.48 The successive nucleotides of DNA are covalently linked through:
(A) peptide bonds (B) hydrogen bonds
(C) glycosidic bonds (D)phosphodiester bonds

Q.49 Replication is:
(A) DNA → DNA (B) DNA → RNA
(C) RNA → DNA (D) DNA → Proteins

Q.50 The process of DNA replication is:
(A) dispersive (B) conservative
(C) semiconservative (D) non-conservative

Q.51 A sequence of three bases codes along the DNA molecule is called:
(A) genome (B) genetic drift
(C) gene pool (D) genetic code

Q.52 A codon consists of:
(A) 1 nucleotide (B) 2 nucleotides
(C) 3 nucleotides (D) 4 nucleotides

Q.53 Translation is a process in which:
(A) DNA is formed on DNA template
(B) RNA is formed on DNA template
(C) DNA is formed on RNA template
(D) Protein is formed from RNA message

Q.54 Nucleic acids are
(A) Small molecules
(B) Dipeptides
(C) Long chain polymers of nucleotides
(D) Polypeptides

Q.55 Bases common to RNA and DNA are
(A) Adenine, guanine, cytosine
(B) Adenine, uracil, cytosine
(C) Adenine, guanine, thymine
(D) Guanine, uracil, thymine.

PART 6 : CLASSIFICATION OF POLYMERS

Q.56 Which of the following is a natural polymer
(A) Polyester (B) Glyptal
(C) Starch (D) Nylon-6

Q.57 Which is a naturally occuring polymer
(A) Polythene (B) PVC
(C) Acetic acid (D) Protein

Q.58 Polythene is
(A) Thermoplastic (B) Thermosetting
(C) Both (A) and (B) (D) None of these

Q.59 Bakelites are
(A) Rubber (B) Rayon
(C) Resins (D) Plasticisers

Q.60 Which of the following is not an example of natural polymer
(A) Wool (B) Silk
(C) Leather (D) Nylon

Q.61 Which is not a polymer
(A) Ice (B) Starch
(C) Protein (D) Cellulose

Q.62 In elastomer, intermolecular forces are
(A) Nil (B) Weak
(C) Strong (D) Very strong

Q.63 Resins and rubber are the examples of
(A) natural polymers (B) synthetic polymers
(C) semi-synthetic polymers (D) None of these

Q.64 The S in buna-S refers to
(A) Sulphur (B) Styrene
(C) Sodium (D) Salicylate

Q.65 An example of condensation polymer is
(A) buna-S (B) polythene
(C) styrene (D) nylon-6, 6

Q.66 Bakelite is an example of
(A) Elastomer (B) Fibre
(C) Thermoplastic (D) Thermosetting

Q.67 Low density polythene is an example of
(A) cross-linked polymer (B) natural polymer
(C) linear polymer (D) branched polymer

Q.68 Which among the following is a cross linked polymer?
(A) Polyesters (B) Glycogens
(C) Melamine formaldehyde (D) Polyvinyl chloride

Q.69 Which of the following is not an example of addition polymer ?
(A) Polythene (B) Polystyrene
(C) Neoprene (D) Nylon 6, 6

Q.70 Identify the type of polymer.
(i) – A – A – A – A – A – A –
(ii) – A – B – B – A – A – A – B – A –
(A) (i) Homopolymer, (ii) Copolymer
(B) (i) Natural polymer, (ii) Synthetic polymer
(C) (i) Linear polymer, (ii) Branched polymer
(D) (i) Fibre, (ii) Elastomer

PART 7 : POLYMERISATION

Q.71 Polymerization of glycol with dicarboxylic acids is
(A) Addition polymerisation
(B) Condensation polymerisation
(C) Telomerisation
(D) Any of these

Q.72 Teflon is a polymer of the monomer **or** Teflon is obtained by the polymerisation of
(A) Monofluoroethene (B) Difluoroethene
(C) Trifluoroethene (D) Tetrafluoroethene

Q.73 The catalyst used for the polymerisation of olefins is
(A) Ziegler Natta catalyst (B) Wilkinson's catalyst
(C) Pd-catalyst (D) Zeise's salt catalyst

Q.74 P.V.C. is formed by polymerisation of-
(A) 1-Chloroethene (B) Ethene
(C) Propene (D) 1-Chloropropene

Q.75 High density polythene is obtained by
(A) Polymerisation of ethene in a hydrocarbon solvent in the presence of Ziegler-Natta catalyst.
(B) Polymerisation of ethene under high pressure and temperature.
(C) Free radical polymerisation of ethene at low temperature in presence of peroxide.
(D) Polymerisation of ethene in presence of carbon tetrachloride.

Q.76 Formation of nylons and polyesters are called step growth polymerisation because
(A) The polymers are formed by adding a monomer step by step.
(B) The polymers are formed by condensation and monomers are joined by loss of simple molecules like water.

(C) The monomers used for condensation are unsaturated molecules.
(D) The polymers are formed by addition of a large number of free radicals formed by monomers.

Q.77 The step by which the addition polymerisation reaction starts is called –
(A) chain initiating step (B) chain propagating step
(C) chain terminating step (D) None of these

Q.78 In vulcanization of rubber
(A) Sulphur reacts to form a new compound.
(B) Sulphur cross-links are introduced.
(C) Sulphur forms a very thin protective layer over rubber.
(D) All statements are correct.

PART 8 : IMPORTANT POLYMERS

Q.79 Few polymers are matched with their uses. Point out the wrong match.
(A) Polyesters - Fabric, tyre cords, safety belts
(B) Nylon 6 - Ropes, tyre cords, fabrics
(C) Bakelite - Packaging industry, lubricant
(D) Teflon - Oil seals, gaskets, non-stick utensils

Q.80 Nylon-66 is a
(A) Natural polymer (B) Condensation polymer
(C) Addition polymer (D) Substitution polymer

Q.81 Nylon yarns are usually
(A) Highly inflammable
(B) Non-inflammable
(C) Both (A) and (B) types are known
(D) Uncertain inflammability

Q.82 Which one of the following is used to make 'non-stick' cookware?
(A) PVC
(B) Polystyrene
(C) Polyethylene teraphthalate
(D) Polytetrafluoroethylene

Q.83 PHBV stands for
(A) Poly β-hydroxybutyrate valerate.
(B) Poly-hydroxy butyrate valerate.
(C) Poly β-hydroxy butyrate-co-β-hydroxy valerate
(D) Poly α-hydroxy butyrate-co-β-hydroxy valerate.

Q.84 Which of the following is a biodegradable synthetic polymer ?
(A) Aliphatic polyesters (B) PHBV
(C) Nylon-2 nylon-6 (D) All of these

PART 9 : DRUGS

Q.85 Which of the following is a hypnotic drug
(A) Luminal (B) Salol
(C) Catechol (D) Chemisol

Q.86 An antipyretic is
(A) Quinine (B) Paracetamol
(C) Luminal (D) Piperazine

Q.87 Which of the following is not an antiseptic drug
(A) Iodoform (B) Dettol
(C) Gammexane (D) Genatian violet

Q.88 A drug effective in the treatment of pneumonia, bronchitis, etc, is
(A) Streptomycin (B) Chloramphenicol
(C) Penicillin (D) Sulphaguanidine

Q.89 Morphine is
(A) Anaesthetic (B) Analgesic
(C) Antiseptic (D) Antibiotics

Q.90 Arsenic drugs are mainly used in the treatment of
(A) Jaundice (B) Typhoid
(C) Syphilis (D) Cholera

Q.91 Which of the following is not an antipyretic
(A) Aspirin (B) Paracetamol
(C) Barbituric acid (D) Phenacetin

Q.92 A broad spectrum antibiotic is-
(A) paracetamol (B) penicillin
(C) aspirin (D) chloramphenicol

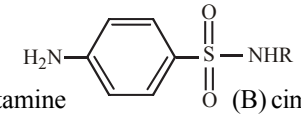
Q.93 The term 'broad spectrum antibiotics'means
(A) Bactericidal antibiotics.
(B) Bacteriostatic antibiotics.
(C) Which kill or inhibit a wide range of gram –ve and gram +ve bacteria
(D) Which kill or inhibit all types of gram +ve bacteria.

Q.94 Which of the following will not act as a tranquilizer?
(A) Equanil (B) Analgin
(C) Meprobamate (D) Chlordiazepoxide

Q.95 Which of the following defines the term opiates?
(A) Narcotic analgesics obtained from the opium poppy.
(B) Non-narcotic analgesics which reduce fever.
(C) Narcotic drugs that inhibit pathogenic microbes.
(D) Tranquilizers used to induce sleep.

Q.96 For receiving the messages
(A) shape of receptor site changes.
(B) shape of receptor site remain same.
(C) binding site of the receptor blocks.
(D) binding site of the receptor degrades.

Q.97 Following figure represent the structural features of



(A) histamine (B) cimetidine
(C) equanil (D) sulphonamides

Q.98 Which of the following antibiotics is bactericidal?
(A) Erythromycin (B) Tetracycline
(C) Penicillin (D) Chloramphenicol

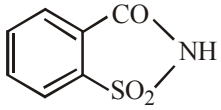
Q.99 A drug which is effective in curing malaria is
(A) Aspirin (B) Quinine
(C) Morphine (D) Analgin

PART 10 : CHEMICALS IN FOOD

Q.100 What is the problem faced while using alitamine as artificial sweetener ?
(A) It decomposes when added to the food items.
(B) It provides a huge number of calories to the food.
(C) It is difficult to control the sweetness of food while using it.
(D) It increases the volume of the contents to a large extent.

Q.101 Which of the following chemicals can be added for sweetening of food items at cooking temperature and does not provide calories ?
(A) Sucrose (B) Glucose
(C) Aspartame (D) Sucralose

Q.102 Aspartame is one of the good artificial sweeteners whose use is limited to cold foods and soft drinks because
(A) Aspartame has very boiling point.
(B) Aspartame gets dissociated at cooking temperature.
(C) Aspartame is sweetener at low temperatures only.
(D) Aspartame is not soluble at higher temperatures.

Q.103  is the structure of –
(A) aspartame (B) saccharin
(C) sucralose (D) alitame

Q.104 Antacids are used for the treatment of
(A) basicity (B) acidity
(C) Both (A) and (B) (D) None of the above

Q.105 Name an artificial sweetener which is derivative of sucrose
(A) Saccharine (B) Sucrolose
(C) Sucrobenzamide (D) Aspartame

Q.106 Which of the following is not a food additive ?
(A) Preservatives (B) Sweetening agents
(C) Flavours (D) Oxidants

PART 11 : CLEANSING AGENTS

Q.107 Glycerol is added to soap. It functions ____
(A) As a filler
(B) To increase lathering
(C) To prevent rapid drying
(D) To make soap granules

Q.108 Which is not true for a detergent molecule ?
(A) It has a non-polar organic part and a polar group.
(B) It is not easily biodegraded.
(C) It is a sodium salt of fatty acid.
(D) It is a surface active reagent.

Q.109 Compound which is added to soap to impart antiseptic properties is _____.
(A) Sodium laurylsulphate
(B) Sodium dodecylbenzenesulphonate
(C) Rosin
(D) Bithional

Q.110 Which of the following is obtained when an oil is hydrolysed with alkali
(A) Fat (B) Wax
(C) Soap (D) Vitamin

Q.111 The main difference between bathing and washing soap is
(A) Bathing soaps are potassium salts of fatty acids while washing soaps are sodium salts of fatty acids.
(B) Bathing soaps are sodium salts of fatty acids while washing soaps are potassium salts of fatty acids.
(C) Bathing soaps are cationic in nature while washing soaps are anionic.
(D) Bathing soaps are calcium salts of fatty acids while washing soaps are magnesium salts of fatty acids.

Q.112 Transparent soaps are made by dissolving the soap in –
(A) methanol (B) ethanol
(C) propanol (D) butanol

Q.113 Which of the following enhances lathering property of soap ?
(A) Sodium carbonate (B) Sodium rosinate
(C) Sodium sterate (D) Trisodium phosphate

EXERCISE - 2 [LEVEL-2]

PART - A (BIOMOLECULES)

Choose one correct response for each question.

Q.1 The intermediate compound formed in the conversion of starch to glucose is
(A) Lactose (B) Sucrose
(C) Maltose (D) Fructose

Q.2 Which compound can exist in a dipolar (Zwitter ion) state
(A) $C_6H_5CH_2CH(N=CH_2)COOH$
(B) $(CH_3)_2CH.CH(NH_2)COOH$
(C) $C_6H_5CONHCH_2COOH$
(D) $HOOC.CH_2CH_2COCOOH$

Q.3 Oxidation of glucose is one of the most important reactions in a living cell. What is the number of ATP molecules generated in cells from one molecule of glucose
(A) 38 (B) 12
(C) 18 (D) 28

Q.4 If one strand of DNA has the nucleotide sequence 5′GATCAA-3′, its complementary strand will have the sequence:
(A) 5′-CTAGTT-3′ (B) 5′-TTGATC-3′
(C) 5′-TTCATC-3′ (D) 5′-TTGTTC-3′

Q.5 Find the correct combination that can form a nucleotide of RNA:
(A) uracil + ribose + phosphate
(B) thymine + ribose + phosphate
(C) uracil + deoxyribose + phosphate
(D) Adenine + deoxyribose + phosphate

Q.6 An amino acid without asymmetrical carbon atom is-
(A) Glycine (B) Threonine
(C) Proline (D) Histidine

Q.7 The number of essential amino acids in man is
(A) 8 (B) 10
(C) 18 (D) 20

Q.8 A biological catalyst is essentially
(A) A carbohydrates (B) An amino acids
(C) A nitrogen molecule (D) Fats

Q.9 Which of the following is not a function of proteins
(A) Nails formation
(B) Skin formation
(C) Muscle formation
(D) Providing energy for metabolism

Q.10 The process by which synthesis of protein takes place based on the genetic information present in m-RNA is called
(A) Translation (B) Transcription
(C) Replication (D) Messenger hypothesis

Q.11 Which is used in our body as a fuel for muscles and nerves and to build and repair body tissues?
(A) Cane sugar (B) Fructose
(C) Proteins (D) Glucose

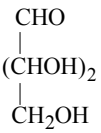
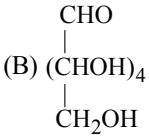
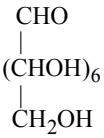
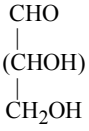
Q.12 The protein which maintains blood sugar level in the human body
(A) Haemoglobin (B) Oxytocin
(C) Insulin (D) Ptyalin

Q.13 In DNA, the complementary bases are
(A) Uracil and adenine; cytosine and guanine
(B) Adenine and thymine; guanine and cytosine
(C) Adenine and thymine; guanine and uracil
(D) Adenine and guanine; thymine and cytosine

Q.14 A gene is a segment of a molecule of
(A) DNA (B) m-RNA
(C) t-RNA (D) Protein

Q.15 In fibrous proteins, polypeptide chains are held together by
(A) Van der waals forces
(B) Electrostatic forces of attraction
(C) Hydrogen bonds
(D) Covalent bonds.

Q.16 What is the structure of glucose?

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

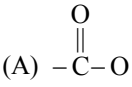
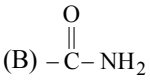
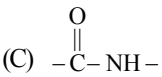
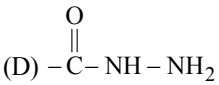
Q.17 On boiling the egg, what structural changes are taking place in the egg white ?
(A) The colour of the egg changes from colourless to white.
(B) 2° and 3° structures are destroyed but 1° structure remains intact.
(C) 1°, 2° & 3° structures of egg are destroyed.
(D) A reversible change takes place which can be reversed by decreasing the temperature.

Q.18 Invert sugar is
(A) A type of cane sugar
(B) Optically inactive form of sugar
(C) Mixture of glucose and galactose
(D) Mixture of glucose and fructose in equimolar quantities.

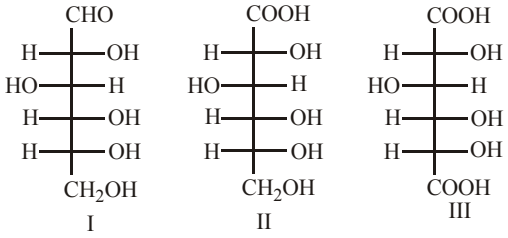
Q.19 Vitamin A is present in
(A) Fish liver oil (B) Milk
(C) Butter (D) All of these

Q.20 Which one of the following amino acid has phenyl – OH group?
(A) Lysine (B) Arginine
(C) Proline (D) Tyrosine

Q.21 Peptide linkage is –

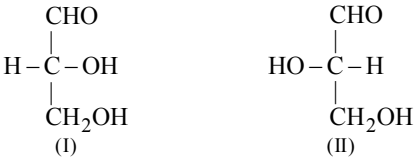
(A) 
(B) 
(C) 
(D) 

Q.22 The spatial arrangement of different OH groups in the molecules is given.



Choose the option with correct names for I, II and III.
(A) I : Gluconic acid, II : Glucose, III : Saccharic acid
(B) I : Saccharic acid, II : Glucose, III : Gluconic acid
(C) I : Glucose, II : Gluconic acid, III : Saccharic acid
(D) I : Glucose, II : Saccharic acid, III : Gluconic acid

Q.23 The given strucutres (I) and (II) represent configuration of the simplest sugar glyceraldehyde. Which of the following statements is not correct for the structures ?



(A) (I) represents D-form while (II) represents L-form of glyceraldehyde.
(B) The sugars having same configuration as D-glyceraldehyde are designated as D-sugars.
(C) Natural glucose and fructose are D-forms
(D) D is dextrorotatory while L is laevoratatory enantiomers.

Q.24 Which of the following B-group vitamins can be stored in our body ?
(A) Vitamin B_1 (B) Vitamin B_2
(C) Vitamin B_6 (D) Vitamin B_{12}

Q.25 The melting points of amino acids are higher than the corresponding halo-acids because
(A) Amino acids exist as zwitter ions resulting in strong dipole-dipole attraction.

(B) Amino acids are optically active.
(C) Due to higher molecular mass of $-NH_2$ group molecular mass of amino acids is higher.
(D) They interact with water more than halo-acids and have salt like structure.

Q.26 Select the base which is not common in DNA and RNA.
(A) Adenine (A) (B) Guanine (G)
(C) Cytosine (C) (D) Uracil (U)

Q.27 The conversion of maltose into glucose is possible by the enzyme
(A) Zymase (B) Lactase
(C) Maltase (D) Diastase

Q.28 I. Glucose occur freely in nature.
II. Glucose occur in the combined form.
III. Glucose present in sweet fruits and honey.
IV. Ripe grapes contain glucose in large amounts.
The correct statements are –
(A) I and III only (B) II and III only
(C) IV and I only (D) I, II, III and IV

Q.29 Lysine, $H_2N-(CH_2)_4-\underset{\underset{NH_2}{|}}{CH}-COOH$ is –
I. α-amino acid
II. basic amino acid
III. amino acid synthesised in body
IV. β-amino acid
Select the option with correct properties about lysine.
(A) I and II (B) II and III
(C) III and IV (D) IV and I

Q.30 Which compound can exist in a dipolar (zwitter ion) structure ?
(A) $C_6H_5CH_2CH(N=CH_2)COOH$
(B) $(CH_3)_2CHCH(NH_2)COOH$
(C) $C_6H_5CONHCH_2COOH$
(D) $HOOCCH_2CH_2COCOOH$

Q.31 How the α-form of glucose is obtained?
(A) It is obtained by the crystallisation from concentrated solution of glucose at 317 K.
(B) It is obtained by the crystallisation from concentrated solution of glucose at 303 K.
(C) It is obtained by the crystallisation from hot saturated aqueous solution at 303 K.
(D) It is obtained by the crystallisation from hot and saturated aqueous solution at 371 K.

Q.32 Amino acids –
I. are colourless, crystalline solids.
II. are water soluble and have high melting solids.
III. behave like salts rather than simple amines or carboxylic acids.
Correct statements are –
(A) I and II (B) II and III
(C) Only III (D) All of these

Q.33 RNA molecules are of three types which are based on their different functions. These are
(A) Messenger RNA, translational RNA, structural RNA.
(B) Cytosine RNA, nucleoside RNA, nucleotide RNA.
(C) Messenger RNA, ribosomal RNA, transfer RNA.
(D) Primary RNA, secondary RNA, tertiary RNA.

Q.34 Amino acids are classified as α, β, γ, δ on the basis of
(A) their relative position of amino group.
(B) their relative position of amino group with respect to carboxyl group.
(C) their relative position of carboxyl group.
(D) the relative position of ester with respect to carboxyl group.

Q.35 Which one of the following sets of monosaccharides forms sucrose ?
(A) α-D-galactopyranose & α-D-glucopyranose
(B) α-D-glucopyranose and β-D-fructofuranose
(C) β-D-glucopyranose and α-D-fructofuranose
(D) α-D-glucopyranose & β-D-fructopyranose.

Q.36 Which of the following statement is incorrect for maltose–
(A) It is disaccharide
(B) It undergoes mutarotation
(C) It is a reducing sugar
(D) It does not have hemiacetal group.

Q.37 $\text{Glucose} \xrightarrow[\text{(ii) P/HI}]{\text{(i) HCN/H}_3\text{O}^{\oplus}} P$; P is –
(A) n-heptanoic acid (B) 2-methyl hexanoic acid
(C) n-heptane (D) 2-methyl hexane

Q.38 Same osazone derivative is obtained in case of D-glucose, D-Mannose and D-Fructose due –
(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 same configuration at C-3, C-4, C-5 and C-6 but different consitution and configuration at C-1 & C-2 which becomes identical by osazone formation.

Q.39 Glycogen on hydrolysis gives –
(A) Lactose and Glucose (B) Only Glucose
(C) Glucose and Fructose (D) Glucose and Maltose

Q.40 The colour of the precipitate formed when a reducing sugar is heated with Fehling solution is–
(A) Brown (B) Red
(C) Blue (D) Green

Q.41 Hydrolysis of lactose with dilute acid yield
(A) Equimolar mixture of D-glucose and D-glucose.
(B) Equimolar mixture of D-glucose and D-galactose.
(C) Equimolar mixture of D-glucose and D-fructose.
(D) Equimolar mixture of D-galactose and D-galactose.

PART - B (POLYMERS)

Q.1 The plastics if are hard, become soft and readily workable by addition of certain compounds called
(A) Catalysts (B) Telomers
(C) Plasticisers (D) Vulcaniser

Q.2 Which of the following can be polymerised to polythene
(A) Ethylene (B) Ethylene chlorohydrin
(C) Ethyl acetate (D) Ethylmethyl ketone

Q.3 The monomers used in the production of nylon-66 are
(A) Hexamethylene diamine and ethylene glycol
(B) Adipic acid and ethylene glycol
(C) Adipic acid and hexamethylene diamine
(D) Dimethyl terephthalate and ethylene glycol

Q.4 The compound used in the manufacture of terylene is
(A) Ethylene (B) Vinyl chloride
(C) Ethylene glycol (D) Adipic acid

Q.5 Which of the following is a synthetic polymer
(A) Rubber (B) Perspex
(C) Protein (D) Cellulose

Q.6 Orlon is a polymer of-
(A) Styrene (B) Tetrafluoroethylene
(C) Vinyl chloride (D) Acrylonitrile

Q.7 Which one of the following is not an example of chain growth polymer-
(A) Neoprene (B) Buna-S
(C) PMMA (D) Glyptal

Q.8 Ebonite is-
(A) Natural rubber (B) Synthetic rubber
(C) Highly vulcanized rubber (D) Polypropene

Q.9 $F_2C = CF_2$ is a monomer of-
(A) Teflon (B) Glyptal
(C) Nylon-6 (D) Buna-S

Q.10 Which of the following polymers do not involve cross linkages-
(A) Melmac (B) Bakelite
(C) Polythene (D) Vulcanised rubber

Q.11 Triethyl aluminium titanium chloride used in plastic industry is a
(A) Vulcaniser (B) Plasticiser
(C) Ziegler-Natta catalyst (D) Telomer

Q.12 Synthetic fibres like nylon-66 are very strong because –
(A) They have high molecular weights and high melting points.
(B) They have a high degree of cross-linking by strong C – C bond.
(C) They have linear molecules consisting of very long chains.
(D) They have linear molecules interlinked with forces like hydrogen bonding.

Q.13 Which of the following is used in vulcanization of rubber
(A) SF_6 (B) CF_4
(C) Cl_2F_2 (D) C_2F_2

Q.14 Among cellulose, poly(vinyl chloride), nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is -
(A) Nylon (B) Poly (vinyl chloride)
(C) Cellulose (D) Natural Rubber

Q.15 HDP is formed in the presence of catalyst
(A) peroxide (B) Ziegler-Natta
(C) H_2/Ni (D) Br_2 / Ni

Q.16 What is the similarity between buna-N and PHBV?
(A) Both are copolymers
(B) Both are biodegradable
(C) Both have one same manomeric unit
(D) Peroxide catalyst is used in their preparation

Q.17 Which of the following is not true about polymers?
(A) Polymers are high molecular mass macro-molecules.
(B) Polymers may be of natural or synthetic origin.
(C) Condensation polymers are made up of one type of monomers only.
(D) They have high viscosity and do not carry any charge.

Q.18 Arrange the following polymers in an increasing order of intermolecular forces; fibre, plastic, elastomer.
(A) Elastomer < Fibre < Plastic
(B) Elastomer < Plastic < Fibre
(C) Plastic < Elastomer < Fibre
(D) Fibre < Elastomer < Plastic

Q.19 Which factor imparts the crystalline nature to a polymer like nylon ?
(A) Strong intermolecular forces like hydrogen bonding between chains.
(B) Van der Waals force between the polymeric chains.
(C) Close packing of the chains due to ionic bonding between the chains
(D) Three-dimensional network of chains.

Q.20 Dacron is a example of
(A) Polyamides (B) Polypropenes
(C) Polyacrylonitrile (D) Polyesters

Q.21 Which of the following is not an example of rubber?
(A) Polychloroprene (B) Buna-N
(C) Butadiene styrene copolymer (D) Polyacrylonitrile

Q.22 Composition of Ziegler-Natta catalyst is
(A) $(Et_3)_3Al.TiCl_2$ (B) $(Me)_3Al.TiCl_2$
(C) $(Et)_3Al.TiCl_4$ (D) $(Et)_3Al.PtCl_4$

Q.23 In the following reaction,

$$nCH_2 = \underset{\underset{Cl}{|}}{C} - CH = CH_2 \xrightarrow{\text{Polymerisation}} A$$

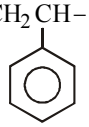
Chloroprene

Here, A refers to

(A) $\left[-CH_2 - \underset{\underset{Cl}{|}}{C} = CH - CH_2-\right]_n$

neoprene

(B) $\left[-CH_2 - CH = CH - CH_2\,CH - CH_2-\right]_n$

SBR 

(C) $\left[-CH_2 - CH_2-\right]_n$ (polythene)

(D) $H_2C = CH - CN$ (vinyl cyanide)

Q.24 Orlon is a
(A) substitute for plastic (B) substitute for paper
(C) substitute for wool (D) substitute for wood

Q.25 cis-Polyisoprene possesses elastic property because –
(A) It is soft and soluble in non-polar solvent.
(B) It is unsaturated and porous.
(C) It has a coiled structure and chains held together by weak van der Waals forces.
(D) It has a fibrous structure and reactive sites at various double bonds.

Q.26 Which of the following represents chloroprene, the monomer of neoprene ?

(A) $CH_2=CH-CH=CH_2Cl$ (B) $CH_2=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH=CHCl$

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

Q.27 Which of the following is not true for thermoplastic polymers ?
(A) Thermoplastics are linear polymers.
(B) They soften and melt on heating.
(C) Molten polymer can be remoulded into any shape.
(D) They have cross-linkages which break on heating.

Q.28 Which of the following statements is not true about low density polythene ?
(A) Tough
(B) Hard
(C) Poor conductor of electricity
(D) Highly branched structure

Q.29 How will you get the monomer for the manufacturing of PVC?
(A) By adding Cl_2 to C_2H_2
(B) By adding HCl to C_2H_4
(C) By adding Cl_2 to C_2H_4
(D) By adding HCl to C_2H_2 (in presence of Hg^{2+} salts)

Q.30 Which of the following polymers does not involve cross linkages ?
(A) Vulcanised rubber (B) Bakelite
(C) Melamine (D) Teflon

Q.31 Glycogen, a naturally occurring polymer stored in animals is a
(A) Monosaccharide (B) Disaccharide
(C) Trisaccharide (D) Polysaccharide

Q.32 Natural rubber is a polymer of
(A) 1, 1-dimethylbutadiene (B)2-methyl-1,3-butadiene
(C) 2-chlorobuta-1, 2-diene (D) 2-chlorobut-2-ene

Q.33 The monomers of biodegradable polymer, nylon 2-nylon 6 are
(A) Glycine + adipic acid
(B) Glycol + phthalic acid
(C) Phenol + urea
(D) Glycine + amino caproic acid.

Q.34 Which of the following sets contains only addition polymers ?
(A) Polyethylene, polypropylene, terylene
(B) Polyethylene, PVC, acrilan
(C) Buna-S, nylon, polybutadiene
(D) Bakelite, PVC, polyethylene

Q.35 I. PVC is useful in making unbreakable cups and laminated sheets.
II. Glyptal is useful in making paints and lacquers.
III. Polypropene is useful in making ropes, toys, pipes, fibres, etc.
IV. Bakelite is useful in making combs, electrical switches, etc.
Correct statement are –
(A) only (I) and (II) (B) only (II) and (III)
(C) (III) and (IV) (D) (II), (III) and (IV)

Q.36 Teflon and neoprene are the examples of
(A) Copolymers (B) Monomers
(C) Homopolymers (D) Condensation polymers

PART C (CHEMISTRY IN EVERYDAY LIFE)

Q.1 Heroin is a derivative of
(A) Cocaine (B) Morphine
(C) Caffeine (D) Nicotine

Q.2 The insecticide containing 99% γ-isomer of benzene hexachloride is known as
(A) Lindane (B) TNT
(C) Malathion (D) Methoxychlor

Q.3 Dettol consist of
(A) Xylenol + Terpeneol
(B) Chlroxylenol + Terpeneol
(C) Cresol + ethnol
(D) None

Q.4 Which of the following drugs combination is not correct ?
(A) Bithinal - Tranquilizer
(B) Chloremphenicol- antibiotics
(C) Equanil -Antidepressant
(D) Phenacetin - Antipyretic .

Q.5 A drug that is antipyretic as well as analgesic is
(A) Chloropromazine hydrochloride
(B) 2 Acetobenzoic acid
(C) Chloroquine
(D) Penicillin

Q.6 Which of the following is an antidiabatic drug
(A) Insulin (B) Penicillin
(C) Chloroquine (D) Aspirin

Q.7 Which of the following is not an antibiotic
(A) Penicillin (B) Sulphaguanidine
(C) Chloramphenical (D) None of these

Q.8 Which of the following is not a broad spectrum antibiotic
(A) Tetracycline (B) Chloromycetin
(C) Penicillin (D) None of these

Q.9 Which of the following can possibly be used as analgesic without causing addiction and any modification
(A) Morphine (B) N-acetylparaaminophenol
(C) Diazepam (D) Tetra hydrocatenol

Q.10 Terfenadine is commonly used as
(A) Antithistamine (B) Antibiotic
(C) Antimicrobial (D) Antifertility drug

Q.11 Which one is a broad spectrum antibiotic ?
(A) Chloramphenicol (B) Plasmoquin
(C) Xylocaine (D) Antiseptic

Q.12 Equanil is _____
(A) Artificial sweetener (B) Transquilizer
(C) Antithistamine (D) Antifertility drug

Q.13 Which of the following is not true about drug receptors
(A) Receptor proteins are embedded in the cell membrane.
(B) The chemical known as chemical messengers are received at the binding sites of receptors.
(C) The receptors show selectivity for one chemical messenger over the other.
(D) Receptor protein is decomposed and destroyed after removal of chemical messenger.

Q.14 Antithistamines are not helpful
(A) In curing nasal allergies.
(B) In treating rashes caused by itching.
(C) In bringing down acute fever.
(D) In vasodilation.

Q.15 Which of the following is not an antidepressants?
(A) Iproniazid (B) Phenelzine
(C) Equanil (D) Salvarsan

Q.16 Which of the following is not a target molecule for drug function in body ?
(A) Carbohydrates (B) Lipids
(C) Vitamins (D) Proteins

Q.17 The compound that causes general antidepressant action on the central nervous system belongs to the class of
(A) Analgesics (B) Tranquilizers
(C) Narcotic analgesics (D) Antihistamines

Q.18 Which of the following will not act as antacid ?
(A) Sodium hydrogencarbonate
(B) Magnesium hydroxide
(C) Sodium carbonate
(D) Aluminium carbonate

Q.19 Which of the following drug inhibits the synthesis of prostaglandins?
(A) Paracetamol (B) Aspirin
(C) Codeine (D) Valium

Q.20 Aspartame, the artificial sweetener is made by a dipeptide of the amino acids
(A) Aspartic acid and phenylalanine
(B) Aspartic acid and glycine
(C) Alanine and glycine
(D) Aspartic acid and glutamic acid

Q.21 Which is the correct statement about birth control pills
(A) Contain estrogen only
(B) Contain progesterone only
(C) Contain a mixture of estrogen and progesterone derivatives
(D) Progesterone enhances ovulation.

Q.22 Which of the following is not an antibiotic ?
(A) Chloramphenicol (B) Ofloxacin
(C) Penicillin (D) Prontosil

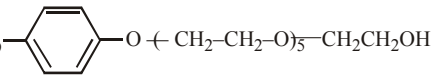
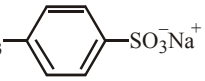
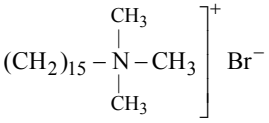
Q.23 Which of the following can be used as an analgesic without causing addiction ?
(A) Morphine (B) Aspirin
(C) Heroin (D) Codeine

Q.24 An ester which is used as a medicine
(A) Ethyl acetate (B) Methyl acetate
(C) Methyl salicylate (D) Ethyl benzoate

Q.25 If strong covalent bond formed between enzyme and drug (inhibitor) then
I. it can't break easily II. it can break easily
III. enzyme block permanently
Correct statements are –
(A) I and II (B) II and III
(C) I and III (D) I, II and III

Q.26 Which of the following is not a correct statement?
(A) Transparent soaps are made by dissolving the soap in ethanol and then evaporating excess solvent.
(B) Soaps that float in water are made by beating tiny air bubbles before their hardening.
(C) Medicated soaps contain alcohol to prevent rapid drying.
(D) Potassium soaps are soft to the skin that sodium soaps.

Q.27 The most useful classification of drugs for medicinal chemists is
(A) On the basis of chemical structure.
(B) On the basis of drug action.
(C) On the basis of molecular targets.
(D) On the basis of pharmacological effect.

Q.28 Which of the following is an example of liquid dishwashing detergent?
(A) $CH_3(CH_2)_{10}-CH_2OSO_3^-Na^+$
(B) 
(C) 
(D) 

Q.29 Antimicrobial drugs include
(i) Antiseptics (ii) Antibiotics (iii) Disinfectants
(A) i and ii (B) i and iii
(C) ii and iii (D) i, ii and iii

Q.30 If the bond formed between an enzyme and an inhibitor is a strong covalent bond and cannot be broken easily, then
(A) the enzyme is blocked permanently.
(B) the body degrades the enzyme-inhibitor complex.
(C) a new enzyme is synthesised.
(D) All of the above.

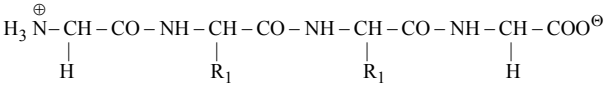
Q.31 Which of the following is not a true statement about the detergents ?
(A) Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons.
(B) Cationic detergents are quarternary ammonium salts of amines with acetates, chlorides or bromides as an ions.
(C) Non-ionic detergents do not contain any ion in their constitution.
(D) Detergents containing branched hydrocarbon chains are biodegradable.

EXERCISE - 3 (NUMERICAL VALUE BASED QUESTIONS)

NOTE : The answer to each question is a NUMERICAL VALUE.

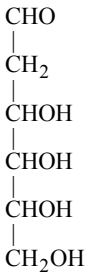
Q.1 A decapeptide (Mol.Wt. 796) on complete hydrolysis gives glycine (Mol.Wt. 75), alanine and phenylalanine. Glycine contributes 47.0 % to the total weight of the hydrolysed products. The number of glycine units present in the decapeptide is

Q.2 The substitutes R_1 and R_2 for nine peptides are listed in the table given below. How many of these peptides are positively changed at pH = 7.0 ?



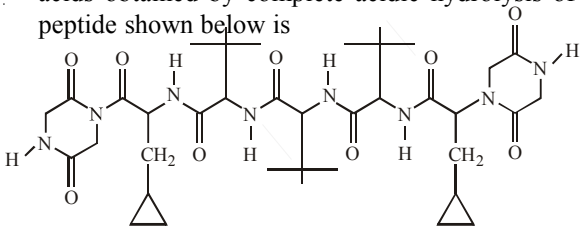
Peptide	R_1	R_2
I	H	H
II	H	CH_3
III	CH_2COOH	H
IV	CH_2CONH_2	$(CH_2)_4NH_2$
V	CH_2CONH_2	CH_2CONH_2
VI	$(CH_2)_4NH_2$	$(CH_2)_4NH_2$
VII	CH_2COOH	CH_2CONH_2
VIII	CH_2OH	$(CH_2)_4NH_2$
IX	$(CH_2)_4NH_2$	CH_3

Q.3 When the following aldohexose exists in its d-configuration the total number of stereoisomers in its pyranose form is



Q.4 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

Q.5 The total number of distinct naturally occurring amino acids obtained by complete acidic hydrolysis of the peptide shown below is

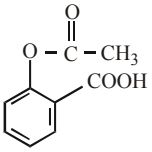


Q.6 Number of condensation polymers are –
Terylene, Bakelite, Polyvinyl chloride, polythene.

Q.7 X% solution of iodine in alcohol and water is called tincture of iodine. Find the lowest integer for the value of X.

EXERCISE - 4 [PREVIOUS YEARS JEE MAIN QUESTIONS]

Q.1 RNA contains - **[AIEEE-2002]**
(A) Urasil, Ribose (B) Thiamine, Ribose
(C) Cytocine, Deoxyribose (D) Adenine, Deoxyribose

Q.2 The compound  is used as - **[AIEEE-2002]**
(A) Antiseptic (B) Antipyretic
(C) Antiallergic (D) Antibiotic

Q.3 Which of the following could act as a propellant for rockets- **[AIEEE-2003]**
(A) Liquid hydrogen + liquid oxygen
(B) Liquid nitrogen + liquid oxygen
(C) Liquid hydrogen + liquid nitrogen
(D) liquid oxygen + liquid argon

Q.4 Complete hydrolysis of cellulose gives – **[AIEEE-2003]**
(A) D-glucose (B) L-glucose
(C) D-fructose (D) D-ribose

Q.5 The reason for double helical structure of DNA is operation of – **[AIEEE-2003]**
(A) Hydrogen bonding (B) Electrostatic attractions
(C) vander Waal's forces (D) Dipole-dipole interaction

Q.6 Monomers are converted to polymer by – **[AIEEE-2003]**
(A) Hydrolysis of monomers
(B) Condensation reaction between monomers
(C) Protonation of monomers
(D) None is correct

Q.7 Nylon threads are made of – **[AIEEE-2003]**
(A) Polyamide polymer (B) Polyethylene polymer
(C) Polyvinyl polymer (D) Polyster polymer

Q.8 Coordination compounds have great importance in biological systems, In this context which of the following statements is incorrect ? **[AIEEE-2004]**
(A) Chlorophylls are green pigments in plants and contain calcium.
(B) haemoglobin is the red pigment of blood and contains iron.
(C) Cyanocobalamin is B_{12} and contains cobalt.
(D) Carboxypeptidase–A is an enzyme and contains zinc.

Q.9 Which base is present in RNA but not in DNA
(A) Uracil (B)Cytosine **[AIEEE-2004]**
(C) Guanine (D) Thymine

Q.10 Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories **[AIEEE-2004]**
(A) A co-enzyme (B) A hormone
(C) An enzyme (D) An antibiotic

Q.11 Identify the correct statement regarding enzymes :
(A) Enzymes are specific biological catalysts that can normally function at very high temperatures (T~1000K). **[AIEEE-2004]**
(B) Enzymes are normally heterogeneous catalysts that are very specific in their action.
(C) Enzymes are specific biological catalysts that cannot be poisoned.
(D) Enzymes are specific biological catalysts that possess well-defined active sites.

Q.12 In both DNA and RNA, heterocylic base and phosphate ester linkages are at – **[AIEEE-2005]**
(A) C_2' and C_5' respectively of the sugar molecule
(B) C_5' and C_2' respectively of the sugar molecule
(C) C_5' and C_1' respectively of the sugar molecule
(D) C_1' and C_5' respectively of the sugar molecule

Q.13 Which one of the following types of drugs reduces fever- **[AIEEE-2005]**
(A) Antipyretic (B) Analgesic
(C) Tranquiliser (D) Antibiotic

Q.14 Which of the following is a polyamide ? **[AIEEE-2005]**
(A) Nylon-66 (B) Teflon
(C) Bakelite (D) Terylene

Q.15 Which of the following is fully fluorinated polymer- **[AIEEE-2005]**
(A) Teflon (B) Neoprene
(C) PVC (D) Thiokol

Q.16 The pyrimidine bases present in DNA are – **[AIEEE 2006]**
(A) cytosine and guanine (B) cytosine and thymine
(C) cytosine and uracil (D) cytosine and adenine

Q.17 The term anomers of glucose refers to – **[AIEEE 2006]**
(A) a mixture of (D)-glucose and (L)-glucose
(B) enantiomers of glucose
(C) isomers of glucose that differ in configuration at carbon one (C-1)
(D) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)

Q.18 The secondary structure of a protein refers to –
(A) α-helical backbone **[AIEEE 2007]**
(B) hydrophobic interactions
(C) sequence of α-amino acids
(D) fixed configuration of the polypeptide backbone

Q.19 α-D-(+)-glucose and β-D-(+)-glucose are **[AIEEE 2008]**
(A) epimers (B) anomers
(C) enantiomers (D) conformers

Q.20 Bakelite is obtained from phenol by reacting with **[AIEEE 2008]**
(A) CH_3CHO (B) CH_3COCH_3
(C) HCHO (D) $(CH_2OH)_2$

Q.21 The two functional groups present in a typical carbohydrate are : **[AIEEE 2009]**
(A) – OH and –COOH (B) – CHO and –COOH
(C) > C = O and –OH (D) – OH and –CHO

Q. 22 Buna-N synthetic rubber is a copolymer of - **[AIEEE 2009]**

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

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

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

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

Q.23 Biuret test is not given by – **[AIEEE 2010]**
(A) carbohydrates (B) polypeptides
(C) urea (D) proteins

Q.24 The polymer containing strong intermolecular forces e.g. hydrogen bonding, is – **[AIEEE 2010]**
(A) teflon (B) nylon 6,6
(C) polystyrene (D) natural rubber

Q.25 The presence or absence of hydroxy group on which carbon atom of sugar differentiates RNA and DNA.
(A) 1^{st} (B) 2^{nd} **[AIEEE 2011]**
(C) 3^{rd} (D) 4^{th}

Q.26 The species which can best serve as an initiator for the cationic polymerization is : **[AIEEE-2012]**
(A) $LiAlH_4$ (B) HNO_3
(C) $AlCl_3$ (D) BaLi

Q.27 Which one of the following statements is correct?
(A) All amino acids except lysine are optically active
(B) All amino acids are optically active. **[AIEEE 2012]**
(C) All amino acids except glycine are optically active
(D) All amino acids except glutamic acids are optically active

Q.28 Which of the following compounds can be detected by Molisch's test : **[AIEEE 2012]**
(A) Nitro compounds (B) Sugars
(C) Amines (D) Primary alcohols

Q.29 Aspirin is known as : **[AIEEE 2012]**
(A) Acetyl salicylic acid (B) Phenyl salicylate
(C) Acetyl salicylate (D) Methyl salicylic acid

Q.30 Synthesis of each molecule of glucose in photosynthesis involves – **[JEE MAIN 2013]**
(A) 18 molecules of ATP (B) 10 molecules of ATP
(C) 8 molecules of ATP (D) 6 molecules of ATP

Q.31 Which one of the following bases is not present in DNA? **[JEE MAIN 2014]**
(A) Cytosine (B) Thymine
(C) Quinoline (D) Adenine

Q.32 Which one is classified as a condensation polymer? **[JEE MAIN 2014]**
(A) Teflon (B) Acrylonitrile
(C) Dacron (D) Neoprene

Q.33 Which of the following compounds is not an antacid? **[JEE MAIN 2015]**
(A) Cimetidine (B) Phenelzine
(C) Ranitidine (D) Aluminium Hydroxide

Q.34 Which of the vitamins is water soluble? **[JEE MAIN 2015]**
(A) Vitamin D (B) Vitamin E
(C) Vitamin K (D) Vitamin C

Q.35 Which polymer is used in the manufacture of paints and lacquers? **[JEE MAIN 2015]**
(A) Glyptal (B) Polypropene
(C) Poly vinyl chloride (D) Bakelite

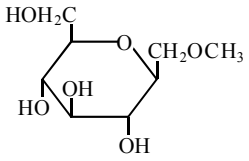
Q.36 Which of the following statements about low density polythene is FALSE ? **[JEE MAIN 2016]**
(A) It is a poor conductor of electricity.
(B) Its synthesis requires dioxygen or a peroxide initiator as a catalyst.
(C) It is used in the manufacture of buckets, dust-bins
(D) Its synthesis requires high pressure.

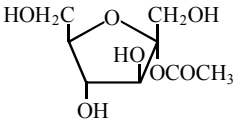
Q.37 Which of the following is an anionic detergent?
(A) Sodium lauryl sulphate **[JEE MAIN 2016]**
(B) Cetyltrimethyl ammonium bromide
(C) Glyceryl oleate
(D) Sodium stearate

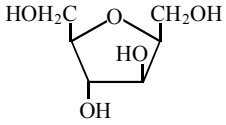
Q.38 Thiol group is present in – **[JEE MAIN 2016]**
(A) Cystine (B) Cysteine
(C) Methionine (D) Cytosine

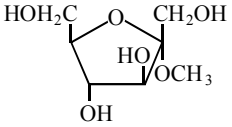
Q.39 The formation of which of the following polymers involves hydrolysis reaction ? **[JEE MAIN 2017]**
(A) Terylene (B) Nylon 6
(C) Bakelite (D) Nylon 6, 6

Q.40 Which of the compounds will behave as a reducing sugar in an aqueous KOH solution. **[JEE MAIN 2017]**

(A) 

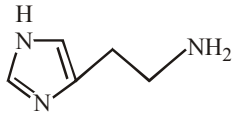
(B) 

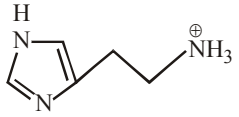
(C) 

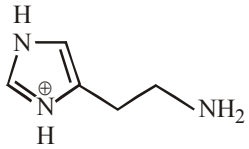
(D) 

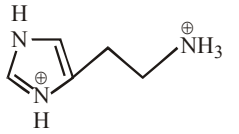
Q.41 Glucose on prolonged heating with HI gives : **[JEE MAIN 2018]**
(A) Hexanoic acid (B) 6-iodohexanal
(C) n-Hexane (D) 1-Hexene

Q.42 The predominant form of histamine present in human blood is (pK_a, Histidine = 6.0) : **[JEE MAIN 2018]**

(A) 

(B) 

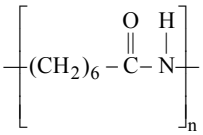
(C) 

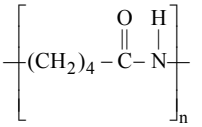
(D) 

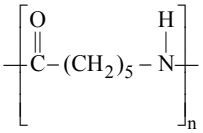
Q.43 The increasing order of pK_a of the following amino acids in aqueous solution is : Gly , Asp , Lys , Arg **[JEE MAIN 2019 (JAN)]**
(A) Asp < Gly < Arg < Lys (B) Arg < Lys < Gly < Asp
(C) Gly < Asp < Arg < Lys (D) Asp < Gly < Lys < Arg

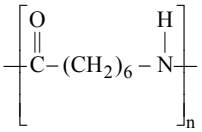
Q.44 Maltose on treatment with dilute HCl gives : **[JEE MAIN 2019 (APRIL)]**
(A) D-Galactose (B) D-Glucose
(C) D-Glucose and D-Fructose (D) D-Fructose

Q.45 The structure of Nylon-6 is : **[JEE MAIN 2019 (APRIL)]**

(A) 

(B) 

(C) 

(D) 

Q.46 Fructose and glucose can be distinguished by : **[JEE MAIN 2019 (APRIL)]**

(A) Fehling's test (B) Barfoed's test
(C) Benedict's test (D) Seliwanoff's test

Q.47 Which of the following statements is not true about sucrose? **[JEE MAIN 2019 (APRIL)]**

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

Q.48 Which of the following is a condensation polymer? **[JEE MAIN 2019 (APRIL)]**

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

Q.49 Amylopectin is composed of : **[JEE MAIN 2019 (APRIL)]**

(A) α-D-glucose, C_1–C_4 and C_1–C_6 linkages
(B) α-D-glucose, C_1–C_4 and C_2–C_6 linkages
(C) β-D-glucose, C_1–C_4 and C_2–C_6 linkages
(D) β-D-Glucose, C_1–C_4 and C_1–C_6 linkages

Q.50 Number of stereo centers present in linear and cyclic structures of glucose are respectively : **[JEE MAIN 2019 (APRIL)]**

(A) 4 & 5 (B) 5 & 5
(C) 4 & 4 (D) 5 & 4

Q.51 Glucose and Galactose are having identical configuration in all the positions except position. **[JEE MAIN 2019 (APRIL)]**

(A) C–3 (B) C–2
(C) C–4 (D) C–5

Q.52 Match the column **[JEE MAIN 2020 (JAN)]**

Column-I	**Column-II**
a. Thiamine	(P) Scurvy
b. Riboflavin	(Q) Beri Beri
c. Pyridoxine	(R) Cheilosis
d. Ascorbic acid	(S) Convulsions

(A) a – Q, b – R, c – P, d – S (B) a – Q, b – R, c – S, d – P
(C) a – R, b – Q, c – S, d – P (D) a – R, b – Q, c – P, d – S

Q.53 The correct statement about gluconic acid is **[JEE MAIN 2020 (JAN)]**

(A) It is prepared by oxidation of glucose with HNO_3.
(B) It is obtained by partial oxidation of glucose.
(C) It is dicarboxylic acid.
(D) It forms hemiactal or acetal.

Q.54 Which of the given statement is incorrect about glucose? **[JEE MAIN 2020 (JAN)]**

(A)Glucose exists in two crystalline forms α and β
(B) Glucose gives schiff's test for aldehyde.
(C) Penta acetate of glucose does not form oxime.
(D) Glucose forms oxime with hydroxyl amine.

Q.55 Number of chiral centres in Pencillin is **[JEE MAIN 2020 (JAN)]**

Q.56 Formation of Bakelite follows : **[JEE MAIN 2020 (JAN)]**

(A) Electrophilic substitution followed by condensation.
(B) Nucleophilic addition followed by dehydration.
(C) Electrophilic addition followed by dehydration.
(D) Hydration followed by condensation.

Q.57 Products formed by hydrolysis of maltose are **[JEE MAIN 2020 (JAN)]**

(A) α-D-Glucose, α-D-Glucose
(B) α-D-Glucose, β-D-Glucose
(C) α-D-Galactose, β-D-Glucose
(D) β-D-Galactose, α-D-Glucose

Q.58 Which polymer has 'chiral' monomer(s) ? **[JEE MAIN 2020 (JAN)]**

(A) Buna-N (B) Nylon 6,6
(C) Neoprene (D) PHBV

Q.59 A, B and C are three biomolecules. The results of the tests performed on them are given below:

	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 : **[JEE MAIN 2020 (JAN)]**

(A) A = Glucose, B = Fructose, C = Albumin
(B) A = Lactose, B = Fructose, C = Alanine
(C) A = Lactose, B = Glucose, C = Alanine
(D) A = Lactose, B = Glucose, C = Albumin

EXERCISE - 5 [PREVIOUS YEARS AIPMT / NEET QUESTIONS]

PART - A (BIOMOLECULES)

Q.1 Which functional group participates in disulphide bond formation in proteins – **[AIPMT 2005]**
(A) Thioester (B) Thioether
(C) Thiol (D) Thiolactone

Q.2 The cell membranes are mainly composed of – **[AIPMT 2005]**
(A) Fats (B) Proteins
(C) Phospholipids (D) Carbohydrates

Q.3 The human body does not produce **[AIPMT 2006]**
(A) Vitamins (B) Hormones
(C) Enzymes (D) DNA

Q.4 During the process of digestion, the proteins present in food material are hydrolysed to amino acids. The two enzymes involved in the process– **[AIPMT 2006]**

$$\text{Proteins} \xrightarrow{\text{Enzyme (A)}} \text{Polypeptides} \xrightarrow{\text{Enzyme (B)}} \text{Amino acid}$$

(A) Diastase and Lipase (B) Pepsin and Trypsin
(C) Invertase and Zymase (D) Amylase and Maltase

Q.5 Which one of the following is a peptide hormone **[AIPMT 2006]**
(A) Testosterone (B) Thyroxin
(C) Adrenaline (D) Glucagon

Q.6 RNA & DNA are chiral molecules, their chirality is due to **[AIPMT 2007]**
(A) chiral bases
(B) chiral phosphate ester units
(C) D-sugar component
(D) L-sugar component

Q.7 Which of the following is water-soluble – **[AIPMT 2007]**
(A) Vitamin E (B) Vitamin K
(C) Vitamin A (D) Vitamin B

Q.8 In DNA, the complimentary bases are: **[AIPMT 2008]**
(A) Uracil and adenine; cytosine and guanine
(B) Adenine and thymine; guanine and cytosine
(C) Adenine and thymine; guanine and uracil
(D) Adenine and guanine; thymine and cytosine

Q.9 Which one of the following is an amine hormone? **[AIPMT 2008]**
(A) Progesterone (B) Thyroxine
(C) Oxypurin (D) Insulin

Q.10 The segment of DNA which acts as the instrumental manual for the synthesis of the protein is: **[AIPMT 2009]**
(A) ribose (B) gene
(C) nucleoside (D) nucleotide

Q.11 Which of the following hormones contains iodine? **[AIPMT 2009]**
(A) testosterone (B) adrenaline
(C) thyroxine (D) insulin

Q.12 Which one of the following does not exhibit the phenomenon of mutarotation? **[AIPMT (PRE) 2010]**
(A) (+) Sucrose (B) (+) Lactose
(C) (+) Maltose (D) (–) Fructose

Q.13 Fructose reduces Tollen's reagent due to : **[AIPMT (MAINS) 2010]**
(A) Asymmetric carbons
(B) Primary alcoholic groups
(C) Secondary alcoholic group
(D) Enolisation of fructose followed by conversion to aldehyde by base

Q.14 Which one of the following statements is not true regarding (+) Lactose? **[AIPMT (PRE) 2011]**
(A) (+) Lactose, $C_{12}H_{22}O_{11}$ contains 8-OH groups.
(B) On hydrolysis (+) Lactose gives equal amount of D(+) glucose & D(+) galactose.
(C) (+) Lactose is a β-glycoside formed by the union of a molecule of D(+) glucose and a molecule of D(+) galactose.
(D) (+) Lactose is reducing sugar and does not exhibit mutarotation.

Q.15 Which of the following is not a fat soluble vitamin **[AIPMT (MAINS) 2011]**
(A) Vitamin B complex (B) Vitamin D
(C) Vitamin E (D) Vitamin A

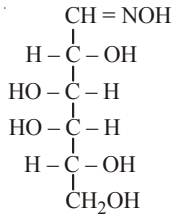
Q.16 Which of the statements about "Denaturation" given below are correct ? **[AIPMT (MAINS) 2011]**
(a) Denaturation of proteins causes loss of secondary and tertiary structures of the protein.
(b) Denturation leads to the conversion of double strand of DNA into single strand.
(c) Denaturation affects primary structure which gets distorted.
(A) (b) & (c) (B) (a) & (c)
(C) (a) & (b) (D) (a), (b) & (c)

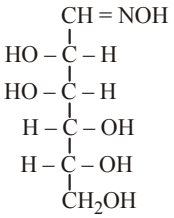
Q.17 Which one of the following, statements is incorrect about enzyme catalysis ? **[AIPMT (PRE) 2012]**
(A) Enzymes are mostly proteinous in nature.
(B) Enzyme action is specific.
(C) Enzymes are denaturated by ultraviolet rays and at high temperature.
(D) Enzymes are least reactive at optimum temperature.

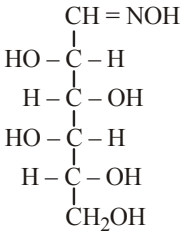
Q.18 Deficiency of vitamin B_1 causes the disease **[AIPMT (PRE) 2012]**
(A) Convulsions (B) Beri-Beri
(C) Cheilosis (D) Sterility

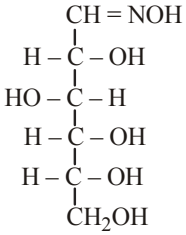
Q.19 Which one of the following sets of monosaccharides forms sucrose ? **[AIPMT (PRE) 2012]**
(A) α-D-Galactopyranose and α-D-Glucopyranose
(B) α-D-Glucopyranose and β-D-fructofuranose
(C) β-D-Glucopyranose and α-D-fructofuranose
(D) α-D-Glucopyranose and β-D-fructopyranose

Q.20 D (+) glucose reacts with hydroxyl amine and yields an oxime. The structure of the oxime would be **[AIPMT 2014]**

(A) 

(B) 

(C) 

(D) 

Q.21 Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human beings? **[AIPMT 2014]**

(A) Thyroxin (B) Insulin
(C) Adrenaline (D) Estradiol

Q.22 In a protein molecule, various amino acids are linked together by **[NEET 2016 PHASE 1]**

(A) α-glycosidic bond (B) β-glycosidic bond
(C) Peptide bond (D) Dative bond

Q.23 The correct statement regarding RNA and DNA, respectively is **[NEET 2016 PHASE 1]**

(A) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose.
(B) The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.
(C) The sugar component in RNA is arabinose and the sugar component in DNA is ribose.
(D) The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.

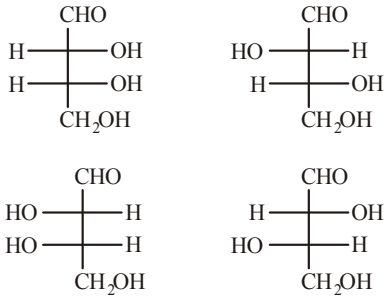
Q.24 Which one given below is a non-reducing sugar? **[NEET 2016 PHASE 1]**

(A) Maltose (B) Lactose
(C) Glucose (D) Sucrose

Q.25 The central dogma of molecular genetics states that the genetic information flows from **[NEET 2016 PHASE 2]**

(A) Amino acids → Proteins → DNA
(B) DNA → Carbohydrates → Proteins
(C) DNA → RNA → Proteins
(D) DNA → RNA → Carbohydrates

Q.26 The correct corresponding order of names of four aldoses with configuration given below respectively, is **[NEET 2016 PHASE 2]**



(A) L-erythrose, L-threose, L-erythrose, D-threose
(B) D-threose, D-erythrose, L-threose, L-erythrose
(C) L-erythrose, L-threose, D-erythrose, D-threose
(D) D-erythrose, D-threose, L-erythrose, L-threose

Q.27 Which of the following statements is not correct **[NEET 2017]**

(A) Ovalbumin is a simple food reserve in egg-white.
(B) Blood proteins thrombin and fibrinogen are involved in blood clotting.
(C) Denaturation makes the proteins more active.
(D) Insulin maintanis sugar level in the blood of a human body.

Q.28 Which of the following compounds can form a zwitterion? **[NEET 2018]**

(A) Benzoic acid (B) Acetanilide
(C) Aniline (D) Glycine

Q.29 The difference between amylose and amylopectin is **[NEET 2018]**

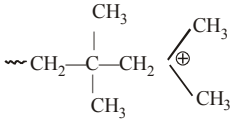
(A) Amylopectin have 1 → 4 α-linkage & 1 → 6 β-linkage
(B) Amylose have 1 → 4 α-linkage and 1 → 6 β-linkage
(C) Amylopectin have 1 → 4 α-linkage & 1→6α-linkage
(D) Amylose is made up of glucose and galactose.

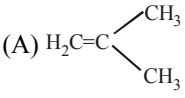
Q.30 The non-essential amino acid among the following is: **[NEET 2019]**

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

PART - B (POLYMERS)

Q.1 The monomer of the polymer **[AIPMT 2005]**



(A) 

(B) $CH_3CH=CH.CH_3$

(C) $CH_3CH=CH_2$

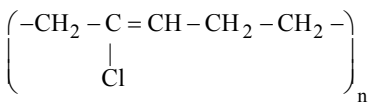
(D) $(CH_3)_2C=C(CH_3)_2$

Q.2 $\sim\!\!\left\{NH(CH_2)NHCO(CH_2)_4CO\right\}_n\!\!\sim$ is a – **[AIPMT 2006]**
(A) Additional polymer (B) Thermosetting polymer
(C) Homopolymer (D) Copolymer

Q.3 Which one of the following polymers is prepared by condensation polymerisation – **[AIPMT 2007]**
(A) Teflon (B) Natural rubber
(C) Styrene (D) Nylon-66

Q.4 Which one of the following statements is not true **[AIPMT 2008]**
(A) Natural rubber is a 1, 4-polymer of isoprene.
(B) In vulcanization, the formation of sulphur bridges between different chains make rubber harder and stronger.
(C) Natural rubber has the trans-configuration at every double bond.
(D) Buna-S is a copolymer of butadiene and styrene.

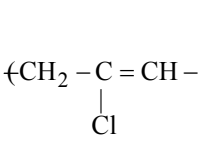
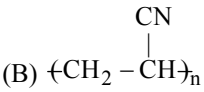
Q.5 Structures of some common polymers are given. Which one is not correctly presented? **[AIPMT 2009]**

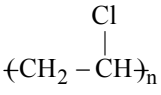
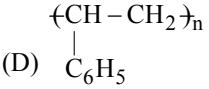
(A) Neoprene 

(B) Terylene 

(C) Nylon 66 : $\left[NH\,(CH_2)_6NHCO(CH_2)_4 - CO\right]_2$
(D) Teflon $\left(CF_2 - CF_2\right)_n$

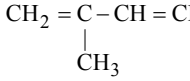
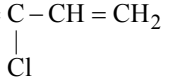
Q.6 Which of the following structures represents Neoprene polymer ? **[AIPMT (PRE) 2010]**

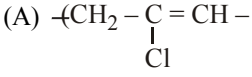
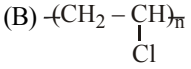
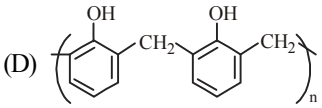
(A)  (B) 

(C)  (D) 

Q.7 Of the following which one is classified as polyester polymer? **[AIPMT (PRE) 2011]**
(A) Nylon-66 (B) Terylene
(C) Bakelite (D) Melamine

Q.8 Nylon is an example of – **[NEET 2013]**
(A) Polythene (B) Polyester
(C) Polysaccharide (D) Polymide

Q.9 Which is the monomer of Neoprene in the following ? **[NEET 2013]**
(A) $CH_2 = CH - C \equiv CH$ (B) $CH_2 = CH - CH = CH_2$
(C)  (D) 

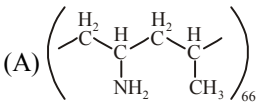
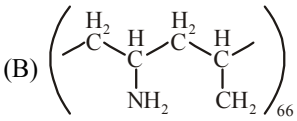
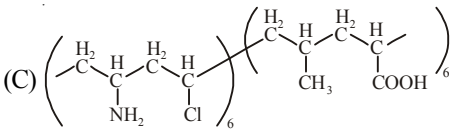
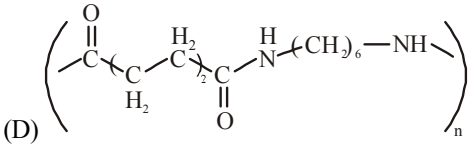
Q.10 Which one of the following is an example of a thermosetting polymer? **[AIPMT 2014]**
(A) 
(B) 
(C) 
(D) 

Q.11 Which of the following organic compounds polymerizes to form the polyester Dacron? **[AIPMT 2014]**
(A) Propylene and para $HO - (C_6H_4) - OH$
(B) Benzoic acid and ethanol
(C) Terephthalic acid and ethylene glycol
(D) Benzoic acid and para $HO - (C_6H_4) - OH$

Q.12 Biodegradable polymer which can be produced from glycine and aminocaproic acid is : **[AIPMT 2015]**
(A) PHBV (B) Buna-N
(C) Nylon 6, 6 (D) Nylon 2-nylon 6

Q.13 Caprolactam is used for the manufacture of : **[RE-AIPMT 2015]**
(A) Terylene (B) Nylon - 6, 6
(C) Nylon - 6 (D) Teflon

Q.14 Natural rubber has – **[NEET 2016 PHASE 1]**
(A) All cis-configuration
(B) All trans-configuration
(C) Alternate cis - and trans-configuration
(D) Random cis - and trans-configuration

Q.15 Which one of the following structures represents nylon 6,6 polymer? **[NEET 2016 PHASE 2]**
(A) 
(B) 
(C) 
(D) 

Q.16 Regarding cross-linked or network polymers, which of the following statements is incorrect? **[NEET 2018]**
(A) Examples are bakelite and melamine.
(B) They are formed from bi- and tri-functional monomers.
(C) They contain covalent bonds between various linear polymer chains.
(D) They contain strong covalents bonds in their polymer chains.

Q.17 The biodegradable polymer is: **[NEET 2019]**
(A) Nylon-6, 6 (B) Nylon-2-Nylon 6
(C) Nylon-6 (D) Buna-S

PART C (CHEMISTRY IN EVERYDAY LIFE)

Q.1 Which one of the following is employed as a tranquilizer? **[AIPMT 2009]**
(A) Naproxen (B) Tetracycline
(C) Chlorpheninamine (D) Equanil

Q.2 Which one of the following is employed as a Tranquilizer drug? **[AIPMT (PRE) 2010]**
(A) Promethazine (B) Valium
(C) Naproxen (D) Mifepristone.

Q.3 Which one of the following is employed as Antithistamine? **[AIPMT (PRE) 2011]**
(A) Omeprazole (B) Chloramphenicol
(C) Diphenyl hydramine (D) Norothindrone

Q.4 Chloroamphenicol is an : **[AIPMT (MAINS) 2012]**
(A) antifertility drug
(B) antihistaminic
(C) antiseptic & disinfectant
(D) antibiotic-broad spectrum

Q.5 Antiseptics and disinfectants either kill or prevent growth of microganisms. Identify which of the following statements is not true **[NEET 2013]**
(A) Disinfectants harm the living tissues.
(B) A 0.2% solution of phenol is an antiseptic while 1% solution acts as a disinfectant.
(C) Chlorine and Iodine are used as strong disinfectants.
(D) Dilute solutions of Boric acid and Hydrogen Peroxide are strong antiseptics.

Q.6 Artificial sweetener which is stable under cold conditions only is – **[AIPMT 2014]**
(A) Saccharine (B) Sucralose
(C) Aspartame (D) Alitame

Q.7 Bithional is generally added to the soaps as an additive to function as a/an : **[AIPMT 2015]**
(A) Dryer (B) Buffering agent
(C) Antiseptic (D) Softener

Q.8 Which of the following is an analgesic? **[NEET 2016 PHASE 1]**
(A) Novalgin (B) Penicillin
(C) Streptomycin (D) Chloromycetin

Q.9 Mixture of chloroxylenol and terpineol acts :**[NEET 2017]**
(A) antiseptic (B) antipyretic
(C) antibiotic (D) analgesic

Q.10 Among the following, the narrow spectrum antibiotic is **[NEET 2019]**
(A) Penicillin G (B) Ampicillin
(C) Amoxycillin (D) Chloramphenicol

ANSWER KEY

EXERCISE - 1																								
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
A	C	C	C	D	B	C	A	B	B	D	D	B	A	A	D	A	D	A	A	C	C	B	B	C	C
Q	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
A	B	D	C	D	D	A	D	C	A	C	A	B	B	C	C	A	B	A	B	B	C	D	D	A	C
Q	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
A	D	C	D	C	A	C	D	A	C	D	A	B	A	B	D	D	D	C	D	A	B	D	A	A	A
Q	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
A	B	A	B	C	B	C	D	C	D	A	B	C	C	B	C	C	D	C	B	A	A	D	C	B	C
Q	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**												
A	D	B	B	B	B	D	C	C	D	C	A	B	B												

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

EXERCISE - 2 (PART-B)																								
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
A	C	A	C	C	B	D	D	C	A	C	C	D	A	D	B	A	C	B	A	D	D	C	A	C	C
Q	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**														
A	C	D	B	D	D	D	B	D	B	D	C														

EXERCISE - 2 (PART-C)																								
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
A	B	A	B	A	B	A	B	C	C	A	A	B	D	C	D	C	B	C	B	A	C	D	B	C	C
Q	**26**	**27**	**28**	**29**	**30**	**31**																			
A	C	C	B	D	D	D																			

EXERCISE - 3							
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**
A	6	4	8	4	1	2	2

EXERCISE - 4																									
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
A	A	B	A	A	A	B	A	A	A	B	D	D	A	A	A	B	C	A	B	C	C	C	A	B	B
Q	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
A	C	C	B	A	A	C	C	B	D	A	C	A	B	B	B	C	C	D	B	C	D	B	B	A	A
Q	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**																
A	C	B	B	B	3	A	A	D	D																

EXERCISE - 5 (PART-A)																								
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
A	C	C	D	B	D	C	D	B	B	B	C	A	D	D	A	C	D	B	B	D	C	C	B	D	C
Q	**26**	**27**	**28**	**29**	**30**																				
A	D	C	D	C	C																				

EXERCISE - 5 (PART-B)																	
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
A	A	D	D	C	A	A	B	D	D	D	C	D	C	A	D	D	B

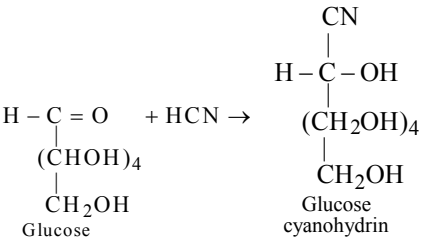
EXERCISE - 5 (PART-C)										
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	D	B	C	D	D	C	C	A	A	A

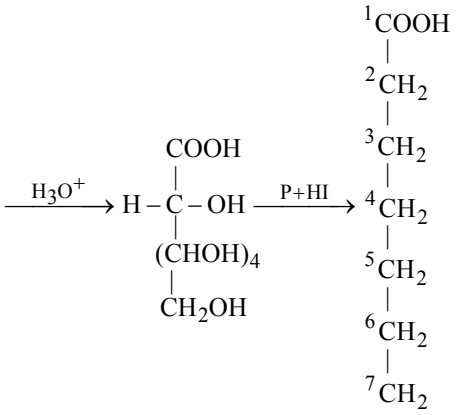
BIOMOLECULES, CHEMISTRY IN EVERYDAY LIFE & POLYMERS

TRY IT YOURSELF-1

(1) **(D).** Maltose-dissaccharide & reducing sugar which undergoes mutarotation.

(2) **(A).**





n-heptanoic acid

(3) **(D).** Same osazone derivative is obtained in case of D-glucose, D-Mannose and D-Fructose due to same constitution and same configuration at C-3, C-4, C-5 and C-6 but different consitution and configuration at C-1 and C-2 which becomes identical by osazone formation.

(4) **(B).** Glycogen hydrolysis with dilute acids gives D(+) glucose.

(5) **(B).** Reducing sugar $\xrightarrow[\text{solution}]{\text{Fehling}}$ Red colouration

(6) **(B).** Hydrolysis of lactose with dil. acid gives equimolar mixture of D-glucose & D-galactose.

Lactose $\xrightarrow{\text{dil acid}}$ D-glucose + D-galactose.

(7) (C)

(8) (D)

(9) (D)

(10) (B)

TRY IT YOURSELF-2

(1) **(B).** Amino acids can exists in dipolar state as zwitter ions.

(2) **(C).** Peptide linkage are amino bonds $\left(-NH-\overset{\overset{O}{\|}}{C}-\right)$ that link amino acid residuces.

(3) (B) **(4)** (D)

(5) (C) **(6)** (A)

(7) (B) **(8)** (B)

(9) (C) **(10)** (C)

(11) (B)

TRY IT YOURSELF-3

(1) (C) **(2)** (A) **(3)** (A)

(4) (B) **(5)** (D) **(6)** (B)

(7) (B) **(8)** (C) **(9)** (C)

(10) (C)

TRY IT YOURSELF-4

(1) (C)

(2) (B)

(3) (B)

(4) (A)

(5) (A)

(6) (C)

(7) (CD)

(8) (BC)

(9) (AC)

(10) (AD)

CHAPTER-13 : BIOMOLECULES,CHEMISTRY IN EVERYDAY LIFE AND POLYMERS

EXERCISE-1

(1) **(C).** Inulin is a carbohydrate which is stored in "Roots of Dahliya".

(2) **(C).** Carbohydrates are hydrates of carbon. Their general formula is $C_x(H_2O)_y$.

(3) **(C).** Sucrose $\xrightarrow{\text{conc.}HNO_3}$ Oxalic acid.

(4) **(D).** Glucose and sucrose are dextrorotatory Fructose is leavorotatory

(5) **(B).** Lactose is present in milk (Glucose+ Galactose).

(6) **(C).** Charring of sugar, when it is treated with sulphuric acid (H_2SO_4) is due to dehydration. In this reaction water is removed from the sugar.

(7) **(A).** Glucose is a monosaccharide while others are polysaccharide. So glucose is the simplest sugar.

(8) **(B).** Fructose has three chiral centres and hence $2^3 = 8$ optical isomers are possible.

(9) **(B).** The formula of starch is $(C_6H_{10}O_5)_n$.

(10) **(D).** Cellulose is abundantly found in nature. It is the main constituent of plant cells.

(11) **(D).**

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

(12) **(B).** The letters 'D' or 'L' before the name of any compound indicate the relative configuration of a particular stereoisomer.

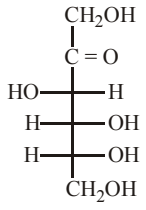
(13) **(A).** Maltose is composed of two α-D-glucose units in which C-1 of one glucose is linked to C-4 of another glucose unit.

(14) **(A).** Examples of carbohydrates are cane sugar, glucose and starch.

(15) **(D).** Cellulose is a polysaccharide and consists of long chain of glucose units linked by β (1 → 4) bonds with each other.

(16) **(A).** Fermentation by diastase will convert starch into maltose but not into glucose. Zymase does not effect starch. Further, dilute NaOH will not hydrolyse starch because the various glucose units in it are linked to each other by glycosidic (ether) linkages which are resistant to hydrolysis by NaOH. Thus, only dilute H_2SO_4 will hydrolyse starch into glucose.

(17) **(D).** Structure of D-(–)-fructose.



OH is at right side mean D.

(18) **(A).** Fibrous proteins are insoluble in water.

(19) **(A).** Protein $\xrightarrow[\text{or change in pH}]{\text{Heated}}$ Denatured protein

(20) **(C).** Simple protein + non-protein material (Prosthetic group or co-factor) → Conjugated protein

(21) **(C).** Protein $\xrightarrow{\text{Enzyme}}$ Amino acid (Acidic medium in stomach)

(22) **(B).** Protein + conc.HNO_3 → Yellow colour
[This test is given by a protein which consists of α-amino acids containing a benzene ring such as tyrosine, phenylalanine etc. The yellow colour is due to nitration of benzene ring.]

(23) **(B).** Proteins are polymers of amino acids.
Amino acid → Dipeptide → Polypeptide → Protein.

(24) **(C).** Proteins are nitrogenous compounds.

(25) **(C).** Antigens are polysaccharides present on RBC's surface.

(26) **(B).** It is the general formula for polysaccharides.

(27) **(D).** All these are the examples of globular proteins. These are soluble in water.

(28) **(C).** Secondary structure of protein refers to folding pattern of polypeptide chains like α-helix and β-pleated sheets.

(29) **(D).** Denaturation results in loss of both secondary and tertiary structures.

(30) **(D).** Keratin is a fibrous protein present in hair, wool, silk and muscles.

(31) **(A).** The sequence in which the α-amino acids are linked to one another in a protein molecule is called its primary structure.

(32) **(D).** Diastase enzyme converts starch into maltose.

(33) **(C).** The enzyme which combines with non protein part to form a functional enzyme is apoenzyme.

(34) **(A).**

(35) **(C).** A nonprotein organic part attached firmly by a covalent linkage to the apoenzyme is called coenzyme.

(36) **(A).** An enzyme (protein) is a biological catalyst.

(37) **(B).** Enzymes are made up of proteins with specific structure.

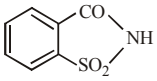
(38) **(B).** Vitamin E is mainly present in vegetable oils like wheat germ oil, sunflower oil, etc.

(39) **(C).** Vitamin B_1 is thiamine. Its main source is cereals.

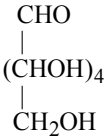
(40) **(C).** Riboflavin (vitamin B_2) is water soluble vitamin. All other vitamins i.e., tocopherol (vitamin E), phylloquinone (vitamin K) and retinol (vitamin A) are fat soluble vitamins.

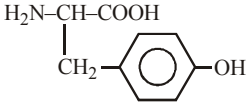
(41) **(A).** Vitamin C is water soluble. Therefore, it is readily excreted in urine and cannot be stored in our body and is supplied regularly in diet.

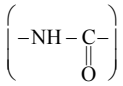
(42) **(B).** Most of the vitamins cannot be synthesized/ produced in human body and are supplied through diet. Only vitamin D can be synthesised in the body by the help of sunlight.
(43) **(A).** Vitamin A or retinol.
(44) **(B).** AGCT are nitrogenous bases of DNA. The pairing is A–T, G–C.
(45) **(B).**
(46) **(C).** Hydrogen bonds between cytosine and guanine are three.
(47) **(D).** The carbon atoms of the pentose sugar involved in phosphodiester bond formation in DNA and RNA are C_3' & C_5'
(48) **(D).** The successive nucleotides of DNA are covalently linked through phosphodiester bonds
(49) **(A).** Replication is DNA $\rightarrow$ DNA
(50) **(C).** The process of DNA replication is semiconservative.
(51) **(D).** A sequence of three bases codes along the DNA molecule is called genetic code.
(52) **(C).** A codon consists of 3 nucleotides.
(53) **(D).** Translation is a process in which protein is formed from RNA message.
(54) **(C).** Nucleic acids are long chain polymers of nucleotides hence they are also called polynucleotides.
(55) **(A).** Adenine, guanine and cytosine are present in both RNA and DNA. DNA contains thymines while RNA contains uracil.
(56) **(C).** Starch is a natural polymer and other are synthetic.
(57) **(D).** Protein is a natural polymer of α-amino acids.
(58) **(A).** Thermoplastic are those which becomes soft on heating and can be remoulded again.
(59) **(C).** Resins are amorphous organic solids or semisolids which usually have a typical lustre and are often transparent or translucent.
(60) **(D).** Nylon is a synthetic polymer.
(61) **(A).** Ice is a molecular solid.
(62) **(B).** Polymer chain in elastomer are held together by weak intermolecular forces eg. Vulacanised rubber.
(63) **(A).** Natural polymers are those polymers which are obtained by plants and animals, e.g., resins and rubbers, etc.
(64) **(B).** Butadiene + Styrene $\rightarrow$ Buna-S
(65) **(D).** Nylon-6, 6 is condensation polymer of hexamethylene diamine and adipic acid. Buna-S and polythene are addition polymers. Sytrene is not a polymer.
(66) **(D).** Bakelite is a thermosetting polymers which is heavily cross-linked and cannot be softened or reused on heating.
(67) **(D).** Low density polythene is an example of branched chain polymer because it contains linear structure having some branches.
(68) **(C).** Melamine-formaldehyde and bakelite, etc. are the cross-linked polymers.
(69) **(D).** Nylon 6, 6 is an example of condensation polymer.
(70) **(A).** Addition polymers formed by polymerisation of a single monomeric species are called homopolymers. When polymerisation takes place between the two different bifunctional monomeric units then are known as copolymers.
(71) **(B).** Condensation Polymerization because loss of water molecule takes place.
(72) **(D).** Tetrafluoroethene ($CF_2 = CF_2$)
(73) **(A).** $Al(C_2H_5)_3 + TiCl_4$ is Ziegler Natta catalyst.
(74) **(A).** P.V.C. is formed by polymerisation of 1-Chloroethene.
(75) **(A).** When ethene in a hydrocarbon solvent in presence of a catalyst like Ziegler-Natta is heated at a temperature of 333-343 K and under pressure of 6-7 atmospheres, a high density polythene is formed.
(76) **(B).** Step growth polymers are condensation polymers. They are formed by the loss of simple molecules like water, alcohol, etc., and lead to the formation of high molecular mass condensation polymers.
(77) **(A).** The polymerisation reaction starts in chain initiating step.
(78) **(B).** In vulcanization of rubber, sulphur forms cross-links to make rubber more elastic.
(79) **(C).** Bakelite is used for making combs, phonograph records, electrical switches and handles of cooking utensils.
(80) **(B).** Nylon-66 is manufactured by the condensation polymerization of adipic acid and hexamethylene-diamine with the lose of H_2O as steam.
(81) **(C).** Both highly inflammable and Non-inflammable
(82) **(D).** Polytetrafluoroethylene is used to make 'non-stick' cookware.
(83) **(C).** PHBV stands for poly β-hydroxy butyrate-co-β-hydroxy valerate. It is a biodegradable polymer.
(84) **(D).** All are the examples of biodegradable polymers.
(85) **(A).** These drugs produce sleep and are habit forming common example of hypnotic drugs are Luminal and Saconal.
(86) **(B).** Antiseptic drugs causes destruction of micro-organism that produce septic disease e.g. Dettol, Savlon acriflavin, Boric acid, Phenol Iodoform, $KMnO_4$ and some dyes such as Chloramine T, methylene blue.
(87) **(C).** It is an insecticide.
(88) **(C).** Penicillin is an effective medicine for Pneumonia disease.
(89) **(B).** Morphine is analgesic.
(90) **(C).** Arsenic drugs are poisonous for syphilis.
(91) **(C).** Rest all are antipyretic, Barbituric acid is tranquilizer.
(92) **(D).** A broad spectrum antibiotic is chloramphenicol.
(93) **(C).** Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be broad spectrum antibiotics.
(94) **(B).** Analgin is an antipyretic.
(95) **(A).** Morphine narcotics are sometimes referred to as opiates, since they are obtained from the opium poppy.
(96) **(A).** To receive the messages, the shape of receptor site changes.

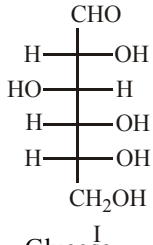
(97) **(D).** The structure is of sulphonamides.
(98) **(C).** Penicillin is a bactericidal antibiotic.
(99) **(B).** Chloroquine is an effective antimalarial drug.
(100) **(C).** Alitame is high potency sweetener although, it is more stable than aspartame, the control of sweetness of food is difficult while using it.
(101) **(D).** Sucralose is trichloro derivative of sucrose. Its appearance and taste are like sugar. It is stable at cooking temperature and does not provide calories.
(102) **(B).** Aspartame gets dissociated at cooking temperature.
(103) **(B).**  is the structure of saccharin.
(104) **(B).** Antacids are used for the treatment of acidity.
(105) **(B).** Sucrolose is trichloro derivative of sucrose. Its appearance and taste are like sugar.
(106) **(D).** Antioxidants are added to food to prevent it from spoiling.
(107) **(C).** Shaving soaps contain glycerol to prevent rapid drying.
(108) **(C).** Detergents are sodium salt of sulphonic acids.
(109) **(D).** Bithionol (or bithional) is added to soaps to impart antiseptic properties.
(110) **(C).** $\text{Oil} + \underset{(\text{alkali})}{\text{NaOH}} \xrightarrow{\text{Saponification}} \text{Glycerol} + \text{Soap}$
(111) **(A).** Bathing soaps are potassium salts of long chain fatty acids while washing soaps are sodium salts of long chain fatty acids.
(112) **(B).** Transparent soaps are made by dissolving the soap in ethanol.
(113) **(B).** Laundry soaps contain fillers like sodium rosinate, sodium silicate, borax and sodium carbonate. Sodium rosinate enhances lathering property of soap.

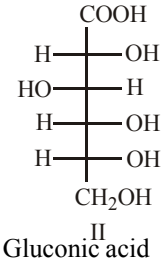
EXERCISE-2
PART - A (BIOMOLECULES)

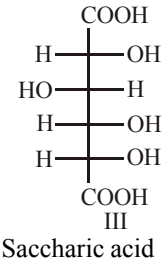
(1) **(C).** Starch $\xrightarrow{\text{Diastage}}$ Maltose $\xrightarrow{\text{Maltase}}$ glucose.
(2) **(B).** Amino acids can exists in dipolar state as zwitter ions.
(3) **(A).** $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38ATP$
(4) **(B).** If one strand of DNA has the nucleotide sequence 5'GATCAA-3', its complementary strand will have the sequence: 5'-TTGATC-3'
(5) **(A).** Uracil + ribose + phosphate
(6) **(A).** A amino acid without asymmetrical carbon atom is Glycine.
(7) **(B).** The amino acids which can't be synthesised by human body so they are essential to take from diet. They are 10 in number.
(8) **(B).** Biological catalysts are enzymes and all enzymes are nucleic acid.
(9) **(D).** Protein is a body building substance not energy giving substance.
(10) **(A).** Synthesis of polypeptide known as translation. For this process three types of RNA are essential.
(11) **(C).** Protein is used in our body as a fuel for muscles and nerves and to build and repair body tissues.
(12) **(C).** Insulin hormone is secreted by pancreas.
(13) **(B).** $\underset{\text{2 hydrogen bonds}}{\text{Adenine} = \text{Thymine}}, \underset{\text{3 hydrogen bonds}}{\text{Guanine} \equiv \text{Cytosine}}$
(14) **(A).** Gene is a part of the DNA molecule that codes for a specific protein.
(15) **(C).** Polypeptide chains in fibrous proteins are held together by disulphide and hydrogen bonds.
(16) **(B).** Structure of glucose is 
(17) **(B).** During denaturation of proteins, 2° and 3° structures are destroyed but primary structure remains intact.
(18) **(D).** Equimolar mixture of α-D-glucose and β-D-fructose is called invert sugar.
(19) **(D).** Vitamin A is present in fish liver oil, milk and butter.
(20) **(D).** Tyrosine has phenyl OH group.



(21) **(C).** Peptide linkage are amino bonds  that link amino acid residues.
(22) **(C).** The exact spatial arrangement of different OH groups was given by Fisher. Its configuration is correctly represented as


I
Glucose,


II
Gluconic acid


III
Saccharic acid

(23) **(D).** D-represents –OH group on the right side of lowest asymmetric C-atom while L represents –OH group on the left.
(24) **(D).** Vitamin B_{12} can be stored in our body.
(25) **(A).** Amino acids exist as zwitter ions, $H_3N^+ - OHR - COO^-$. Because of this dipolar salt-like character, they have strong dipole-dipole attractions. Hence, their melting points are higher then halo-acids.
(26) **(D).** 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).
(27) **(C).** Maltose $\xrightarrow[H^+]{\text{Maltase}}$ Glucose + Glucose

(28) **(D).** Glucose occur freely in nature as well as in the combined form. It is present in sweet fruits and honey. Ripe grapes contain glucose in large amounts.

(29) **(A).** It is α-amino acid and basic amino acid.

(30) **(B).** α-Amino acids exist as zwitter ion.

$$(CH_3)_2CH-\underset{\underset{NH_2}{|}}{CH_3}-COOH \longrightarrow (CH_3)_2CH-\underset{\underset{{}^{+}NH_3}{|}}{CH}-COO^{-}$$

Zwitter ion

(31) **(B).** It is obtained by the crystallisation from concentrated solution of glucose at 303 K.

(32) **(D).** Amino acids are usually colourless, crystalline solids. These are water-soluble, high melting solids and behave like salts rather than simple amines or carboxylic acids. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule.

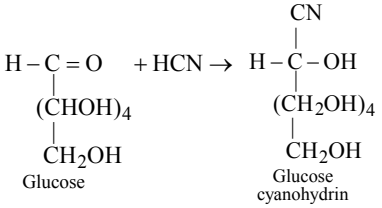
(33) **(C).** Three types of RNA molecules are there which perform different functions. these are messenger RNA (m-RNA) ribosomal RNA (r-RNA) and transfer RNA (t-RNA).

(34) **(B).** On the basis of the relative position of amino group with respect to carboxyl group, the amino acids are classified as α, β, γ, δ and so on.

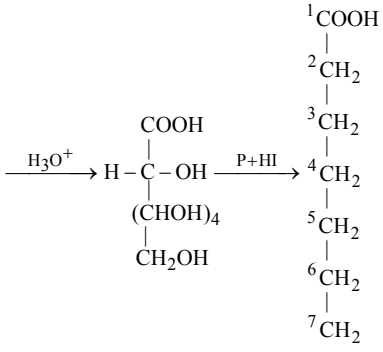
(35) **(B).** Sucrose is formed by the condensation of α-D-glucopyranose & β-D-fructofuranose.

(36) **(D).** Maltose-dissaccharide & reducing sugar which undergoes mutarotation.

(37) **(A).**



Glucose cyanohydrin



n-heptanoic acid

(38) **(D).** Same osazone derivative is obtained in case of D-glucose, D-Mannose and D-Fructose due to same constitution and same 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.

(39) **(B).** Glycogen hydrolysis with dilute acids gives D(+) glucose.

(40) **(B).** Reducing sugar $\xrightarrow[\text{solution}]{\text{Fehling}}$ Red colouration

(41) **(B).** Hydrolysis of lactose with dil. acid gives equimolar mixture of D-glucose & D-galactose.

Lactose $\xrightarrow{\text{dil acid}}$ D-glucose + D-galactose.

PART - B (POLYMERS)

(1) **(C).** e.g.- PVC is extremely stiff and hard but the addition of di-n butyl phthalate Plasticizers makes it soft and rubber like.

(2) **(A).** $\underset{\text{Ethylene}}{n\,CH_2=CH_2} \rightarrow \underset{\text{Polythene}}{(-CH_2-CH_2-)_n}$

(3) **(C).** Adipic acid $(HOOC-(CH_2)_4-COOH)$ and Hexamethylene diamine $(NH_2-(CH_2)_6-NH_2)$

(4) **(C).** Terylene is a polymer of ethylene glycol and terephthalic acid.

(5) **(B).** Perspex is a synthesized polymer.

(6) **(D).** Orlon is a polymer of acrylonitrile.

(7) **(D).** Glyptal is not an example of chain growth polymer.

(8) **(C).** Ebonite is highly vulcanized rubber.

(9) **(A).** $F_2C=CF_2$ is a monomer of teflon.

(10) **(C).** Polythene do not involve cross linkages.

(11) **(C).** Ziegler-Natta catalyst $(C_2H_5)_3Al + TiCl_4$

(12) **(D).** They have linear molecules interlinked with forces like hydrogen bonding.

(13) **(A).** SF_6 is used in the vulcanisation of rubber. Sulphur is heated with polymer to introduce cross-linking and thus, form tough polymer.

(14) **(D).** The intermolecular force of attraction is weakest is natural rubber.

(15) **(B).** Ziegler-Natta catalyst is present in the formation of HDP.

(16) **(A).** Buna-N and PHBV both are copolymers.

(17) **(C).** Condensation polymers are generally made by condensation of two different molecules.

(18) **(B).** Elastomers or rubbers have the weakest intermolecular forces of attraction followed by plastics while fibres have the strongest forces of attraction. Thus, the increasing intermolecular forces of attraction follows the order : elastomer < plastic < fibre.

(19) **(A).** Strong intermolecular forces like hydrogen bonding lead to close packing of chains that impart crystalline character.

(20) **(D).** Dacron is an example of polyesters. It is prepared by heating a mixture of ethylene glycol and terephthalic acid.

(21) **(D).** Except polyacrylonitrile all are synthetic rubbers.

(22) **(C).** Ziegler-Natta catalyst is triethylalluminium and titanium tetrachloride used in the polymerisation of ethene to get high density polyethene.

(23) **(A).** $nCH_2 = \underset{\underset{Cl}{|}}{C} - CH = CH_2 \xrightarrow{\text{Polymerisation}}$

Chloroprene

$$+CH_2 - \underset{\underset{Cl}{|}}{C} = CH - CH_2+_n$$

neoprene

(24) **(C).** Orlon is a substitute for wool.

(25) **(C).** The cis-polyisoprene chains are held together by van der Waals forces and has a coiled structure. Thus, it can be stretched like a spring and exhibits elastic properties.

(26) **(C).** $nCH_2 = \underset{\underset{Cl}{|}}{C} - CH = CH_2 \xrightarrow{\text{Polymerisation}}$

Chloroprene

$$+CH_2 - C = CH - CH_2+_n$$

Neoprene

(27) **(D).** Thermoplastics do not have any cross-linkages hence they are soft and can be remoulded after heating.

(28) **(B).** Low density polythene is tough but flexible (i.e., not too hard) and a poor conductor of electricity and has highly branched structure.

(29) **(D).** By adding HCl to ethylene in presence of Hg^{2+} salts, the monomer vinyl chloride is obtained for the manufacture of PVC.

(30) **(D).** Teflon is an addition linear polymer of tetrafluoroethene.

$$nCF_2 = CF_2 \xrightarrow[\text{High pressure}]{\text{Catalyst}} +CF_2 - CF_2+_n$$

(31) **(D).** Glucose is stored in animal bodies in the form of glycogen which is a polysaccharide.

(32) **(B).** Natural rubber is a polymer of isoprene or 2-methyl-1, 3-butadiene.

$$nCH_2 = \underset{\underset{CH_3}{|}}{C} - CH = CH_2 \xrightarrow{\text{Polymerisation}}$$

Isoprene

$$+CH_2 - \underset{\underset{CH_3}{|}}{C} = CH - CH_2+_n$$

Natural rubber

(33) **(D).** It is a copolymer of glycine ($H_2N - CH_2 - COOH$) and amino caproic acid [$H_2N(CH_2)_5COOH$].

(34) **(B).** Addition polymers : Polyethylene, PVC, acrilan

(35) **(D).** PVC is useful in making raincoats, hand bags etc.

(36) **(C).** Teflon and neoprene are the examples of homopolymers i.e., made up by adding single monomer species.

PART C (CHEMISTRY IN EVERYDAY LIFE)

(1) **(B).** Heroin is acyl derivative of morphine.

(2) **(A).** Lindane or gammexane is γ isomer of BHC.

(3) **(B).** Dettol consist of Chlroxylenol + Terpeneol

(4) **(A).** Chloremphenicol- antibiotics
Equanil -Antidepressant
Phenacetin - Antipyretic .

(5) **(B).** A drug that is antipyretic as well as analgesic is 2 Acetobenzoic acid

(6) **(A).** Insulin is an antidiabatic drug.

(7) **(B).** Antibiotics are those drugs, which act against bacterial and viral infections e.g., Chloramphenicol Streptomycin, Penicillin, Tetracycline etc. Sulphaguanidine is a Sulphadrug.

(8) **(C).** Penicillinis not a broad spectrum antibiotic since it is active against infections caused by gram positive bacteria only.

(9) **(C).** "Diazepam" can be used as analgesic without addition and modification.

(10) **(A).** Terfenadine (seldane) acts as an antihistamine.

(11) **(A).** Chloramphenicol is a broad spectrum antibiotic.

(12) **(B).** Equanil is a tranquilizer used in controlling depression and hypertension.

(13) **(D).** Receptor regains its structure and shape after removal of chemical messenger.

(14) **(C).** Antithistamines are vascodialators and antiallergics.

(15) **(D).** Salvarsan is an antibiotic.

(16) **(C).** Drugs usually interact with biomolecules such as carbohydrates, lipids, proteins and nucleic acids. These are called target molecules or drug targets.

(17) **(B).**

(18) **(C).** Sodium carbonate cannot be administered as antacid.

(19) **(B).** Aspirin inhibits the synthesis of prostaglandins.

(20) **(A).** Aspartame is methyl ester of dipeptide formed from aspartic acid and phenylalanine.

(21) **(C).** Birth control pills contain a mixture of estrogen and progesterone derivatives.

(22) **(D).** Prontosil is an antibacterial agent containing sulphur.

(23) **(B).** Except aspirin, all other drugs are habit forming.

(24) **(C).** Methyl salicylate is commonly known as 'aspirin'and used as an analgesic.

(25) **(C).** If strong covalent bond formed between enzyme and drug (inhibitor) then it can't break easily and enzyme block permanently.

(26) **(C).** Shaving soaps contain glycerol to prevent rapid drying.

(27) **(C).** The classification based on molecular targets is the most useful classification for medicinal chemists.

(28) **(B).** C_4H_{19}–C$_6$H$_4$–O–$+CH_2–CH_2–O+_5$–CH_2CH_2OH

is liquid dishwashing detergent.

(29) **(D).** Antimicrobials destroy or prevent the pathogenic action of microorganisms. Antibiotics, antiseptics and disinfectants are antimicrobial drugs.

(30) **(D).** If the bond formed between an enzyme and an inhibitor is a strong covalent bond and cannot be broken easily, then the enzyme is blocked permanently. The body then degrades the enzyme-inhibitor complex and new enzyme is synthesised.

(31) **(D).** Detergents containing branched hydrocarbon chains are non-biodegradable.

EXERCISE-3

(1) **6.**

Molecular weight of decapeptide = 796 g/mol

Total bonds to be hydrolysed = (10 – 1) = 9 per molecule

Total weight of H_2O added = 9 × 18 = 162 g/mol

Total weight of hydrolysis product = 796 + 162 = 958 g

Total weight % of glycine (given) = 47%

$$\text{Total weight of glycine in product} = \frac{958 \times 47}{100}\text{g} = 450\text{ g}$$

Molecular weight of glycine = 75 g/mol

$$\text{Number of glycine molecule} = \frac{450}{75} = 6$$

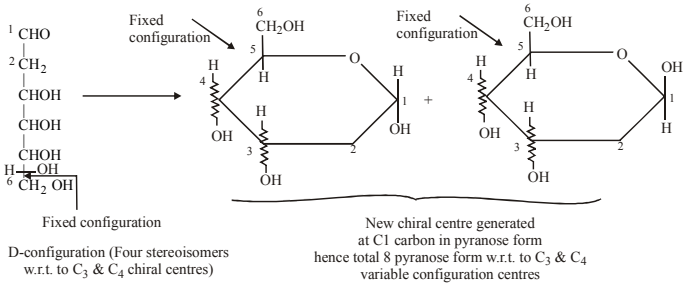
(2) **4.**

(I)	H	H
	Neutral peptide	0
(II)	H	CH_3
	Neutral peptide	0
(III)	CH_2–COOH	H
	Acidic peptide	(–)ve charge
(IV)	CH_2–$CONH_2$	$(CH_2)_4NH_2$
	Basic peptide	(+)ve charge
(V)	CH_2–$CONH_2$	CH_2CONH_2
	Neutral peptide	0
(VI)	$(CH_2)_4$–NH_2	$(CH_2)_4$–NH_2
	Basic peptide	(+)ve charge
(VII)	CH_2–COOH	CH_2CONH_2
	Acidic peptide	(–)ve charge
(VIII)	CH_2OH	$(CH_2)NH_2$
	Basic peptide	(+)ve charge
(IX)	$(CH_2)_4NH_2$	CH_3
	Basic peptide	(+)ve charge

Hence IV, VI, VIII & IX

– CH_2OH, amides $-CH_2\overset{\overset{O}{\|}}{C}-NH_2$ are neutral groups.

(3) **8.**



(4) **4.** Because –COOH group of tetrapeptide is intact on alanine, its NH_2 must be participating in condensation.

∴ Alanine is at one terminus, – – – A.

To fill the 3 blanks, possible options are:

(i) When NH_2 group attached to non chiral carbon

G	V	P
G	P	V

(ii) When NH_2 group attached to chiral carbon

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

where, Glycine (G), Valine (V)

Phenyl alanine (P), Alanine (A)

So the number of possible sequence are 4.

(5) **1.** On hydrolysis only glycine is formed as natural amino acid.

(6) **2.** Addition polymers : Polyvinyl chloride, polythene.

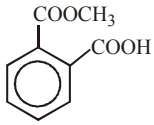
Condensation polymers : Terylene, Bakelite.

(7) **2.** 2-3% solution of iodine in alcohol and water is called tincture of iodine.

EXERCISE-4

(1) **(A).** RNA – contains → Uracil, Ribose

(2) **(B).**



Acetyl salicyclic acid (Apirin → Antipyretic)

(3) **(A).** Liquid hydrogen + liquid oxygen = Rocket propellant.

(4) **(A).** Cellulose + H_2O ⟶ D-glucose

(5) **(A).** Double helical structure of DNA is operated by H-bonding.

(6) **(B).** By condensation

(7) **(A).** $NH_2-(CH_2)_6-NH\boxed{H+HO}OC-(CH_2)_4-COOH$

(Hexamethylenedi amine) (Adipic acid)

$\longrightarrow -NH-(CH_2)_6-\boxed{NH-CO}-(CH_2)_4-CO-$

Amide bond (Nylon-66)

(8) **(A).** Chlorophyll having Mg-metal.

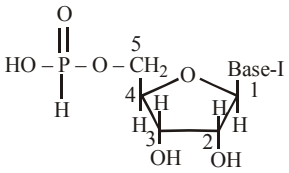
(9) **(A).** RNA → Uracil

DNA → Thymine

(10) **(B).** Insulin → Hormone to control diabetes.

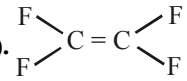
(11) **(D).**

(12) **(D).** In both DNA and RNA, heterocyclic base and phosphate ester linkage are at C'_1 & C'_5 respectively of the sugar molecules.



(13) **(A).** Antipyretic → Reduce the temp. → Reduce the fever. eg. Aspirin.

(14) **(A).**



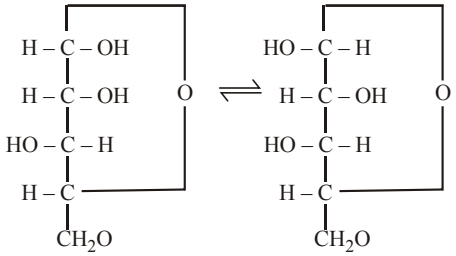
(15) **(A).** Teflon is a fully fluorinated polymer.

(16) **(B).** Pyrimidine → Cyctosine and Thymine base

(17) **(C).** Anomer are those compound which differ in configuration of carbon one (C-1)
Eg : α-D(+) glucose, β-D (+) glucose.

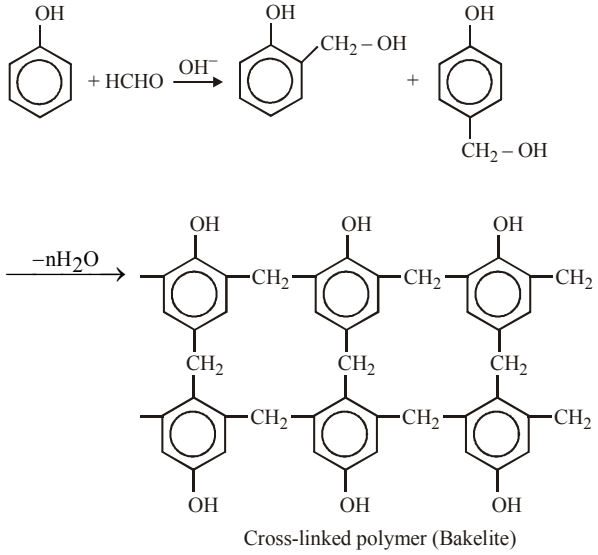
(18) **(A).** Secondary structure of a protein is refer to α-helical backbone.

(19) **(B).** α-D(+) glucose and β-D (+) glucose are anomers because they differ in configuration of carbon one (C-1) as



α-D-(+)-glucose β-D-(+)-glucose

(20) **(C).**



Cross-linked polymer (Bakelite)

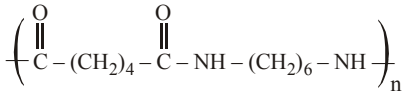
(21) **(C).** Carbohydrate is a polyhydroxy aldehyde or polyhydroxy ketone or any compound which give these on hydrolysis.

 group includes aldehydic as well as ketonic group.

(22) **(C).** Buna–N is a copolymer of buta–1,3–diene and acrylonitrile.

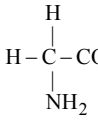
(23) **(A).** It is a test characteristic of amide linkage. Urea also has amide linkage like proteins.

(24) **(B).** Nylon 6,6 is a polymer of adipic acid and hexamethylene diamine.



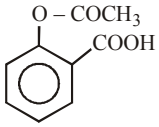
(25) **(B).** RNA and DNA has ribose and deoxyribose sugars, which differs in absence of hydroxy group at 2nd carbon.

(26) **(C).** $AlCl_3$ is a lewis acid and can be used to generate a cation.

(27) **(C).** Only glycine :  is optically inactive amino acid.

(28) **(B)** **Molisch's Test :** This is a general test for carbohydrates.One or two drops of alcoholic solution of α-naphthol is added to 2 ml glucose solution. 1 ml of conc. H_2SO_4 solution is added carefully along the sides of the test tube. The formation of a violet ring at the junction of two liquids confirms the presence of a carbohydrate or sugar.

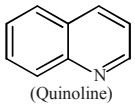
(29) **(A).**



Aspirin (Acetyl salicylic acid)

(30) **(A).** $6CO_2 + 12NADPH + 18\,ATP \rightarrow C_6H_{12}O_6 + 12NADP + 18\,ADP$

(31) **(C).** Adenine, Thymine, Cytosine, Guanine are bases present in DNA.
Quinoline an aromatic compound is NOT present in DNA.



(Quinoline)

(32) **(C).** Teflon, Acrylonitrile and Neoprene are addition polymers while Dacron is a condensation polymer.

(33) **(B).** Phenelzine is not antacid, it is anti-depressant.

(34) **(D).** Vitamin C is water soluble vitamin.

(35) **(A).** Glyptal is used in manufacture of paints and lacquires.

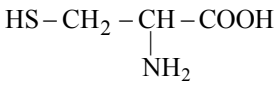
(36) **(C).** Low density polythene is chemically inert and tough but flexible and a poor conductor of electricity. Hence, it is used in the insulation of electricity carrying wires and manufacture of squeeze bottles, toys and flexible pipes.

(37) **(A).**

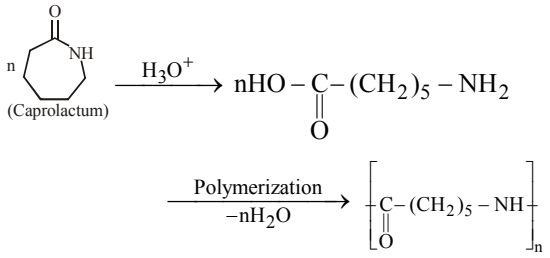
$$CH_3(CH_2)_{10}CH_2OH \xrightarrow{H_2SO_4} CH_3(CH_2)_{10}CH_2OSO_3H \xrightarrow{NaOH\,(aq)} CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$$

Sodium lauryl sulphate (Anionic detergent)

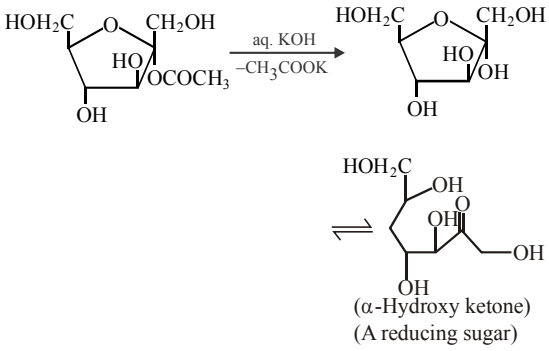
(38) **(B).** Cysteine is amino acid having thiol group



(39) **(B).**

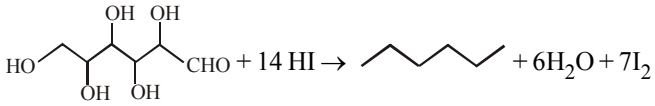


(40) **(B).**



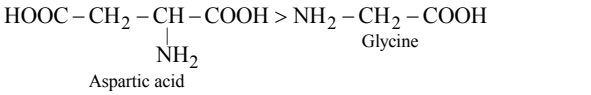
In above compound in presence of aq. KOH (S_NAE) reaction takes place & α-Hydroxy carbonyl compound is formed which give +ve Tollen's test So this compound behave as reducing sugar in an aqueous KOH solution.

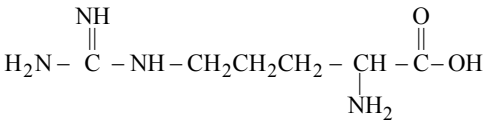
(41) **(C).**



(42) **(C).**

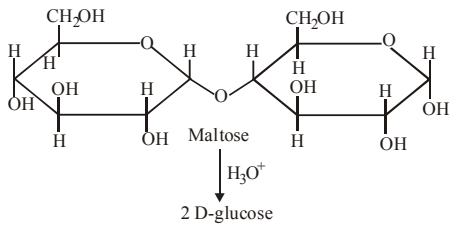
(43) **(D).** Acidic strength $\propto \frac{1}{pK_a}$ Order of acidic strength :



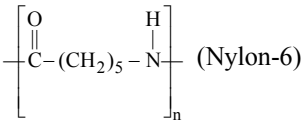


So, pK_a : Asp < Gly < Arg < Lys

(44) **(B).**



(45) **(C).**



(46) **(D).** Seliwanoff's test is used to distinguished aldose and ketose group.

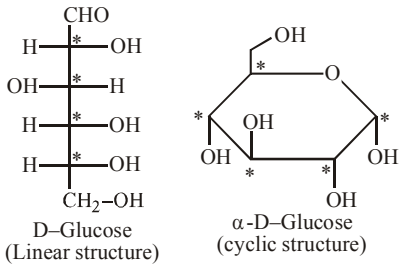
(47) **(B).** Sucrose $\xrightarrow{H_2O}$ α-D-glucose + β-D-fructose

Also named as invert sugar & it is a example of non-reducing sugar.
The glycosidic linkage is present between C_1 of α-glucose & C_2 of β-fructose.

(48) **(B).** Nylon-6,6 is a condensation polymer of hexamethylene diamine and adipic acid. Buna-S, Teflon and Neoprene are addition polymer.

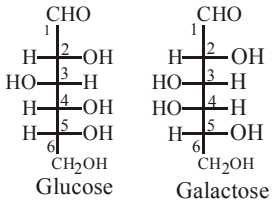
(49) **(A).** Amylopetcin is a homopolymer of α-D-glucose where C_1–C_4 linkage and $C_1 - C_6$ linkage are present.

(50) **(A).**



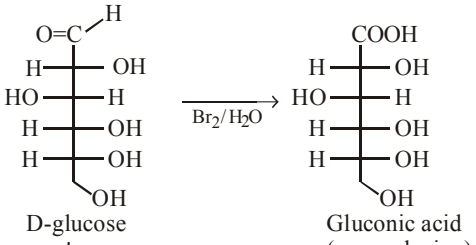
* Stereocenter

(51) **(C).** Glucose and galactose are C-4 Epimer's

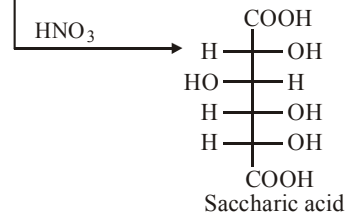


(52) **(B).**

Vitamins	Deficiency Diseases
Vitamin B_1 (Thiamine)	Beri Beri
Vitamin B_2 (Riboflavin)	Cheilosis
Vitamin B_6 (Pyridoxine)	Convulsions
Vitamin C (Ascorbic acid)	Scurvy

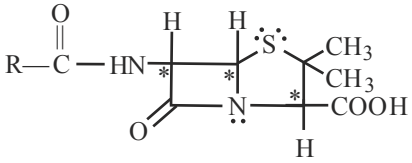


(53) **(B).**



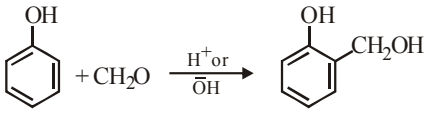
(54) **(B).** Open chain form of glucose is very very small, hence does not gives Schiff's test.

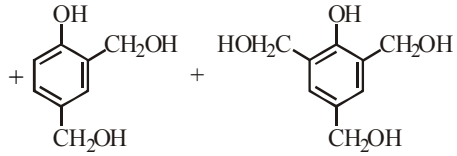
(55) **03.00**

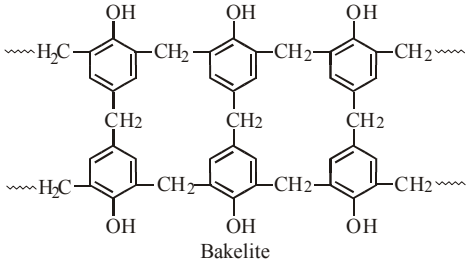


Star marked atoms are chiral centers.

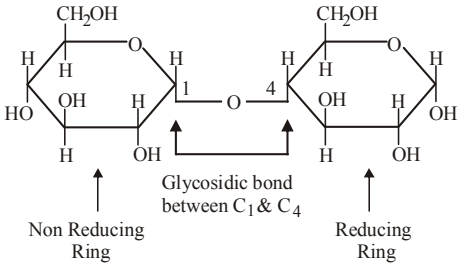
(56) **(A).** Formation of Bakelite follows electrophilic substitution reaction of phenol with formaldehyde followed by condensation.

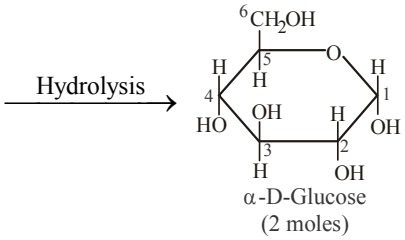






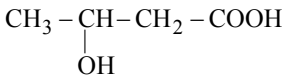
(57) **(A).** Maltose on hydrolysis gives 2 moles of α-D-glucose.



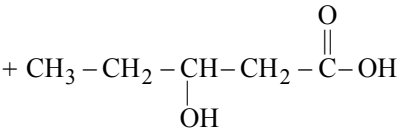


(58) **(D). PHBV :**

Poly β-hydroxy butyrate-co-b-hydroxy valerate



(3-hydroxy butanoic acid)



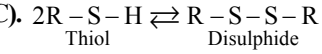
(3-hydroxy pentanoic acid)

(59) **(D).** Alanine does not show Biuret test because Biuret test is used for deduction of peptide linkage & alanine is amino acid.

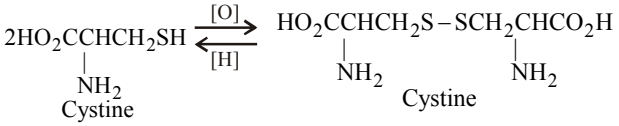
Albumine is protein so have paptide linkage so it gives positive Biuret test.

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

EXERCISE-5
PART - A (BIOMOLECULES)

(1) **(C).** 

Example :



(2) **(C).** Cell membranes (Plasma membranes) constitutes bilayer of phospholipid with embedded proteins. In humans, lipid account for upto 79% of cell membrane.

(3) **(D).** The human body does not produce DNA.

(4) **(B).** Pepsin and Trypsin are two enzymes involved in the process (hydrolysis of proteins)

$$\text{Proteins} \xrightarrow[\text{Stomach}]{\text{Pepsin/HCl}} \text{Proteases and Peptones}$$

$$\xrightarrow[\text{Chemotrypsin}]{\text{Trypsin}} \text{Peptides} \xrightarrow[\text{(Intistine)}]{\text{Peptidases}} \text{Amino acids}$$

(Pancreatic juice intestine)

(5) **(D).** Testorterone and Adrenaline are steroid hormone, Thyroxin is non-steroid hormone, Thyroxin is non-steroided harmon glucagon is peptide hormone.

(6) **(C).** Each nucleic acid consists of a pentose sugar a heterocyclic base, and phosphoric acid. The sugar present in DNA is 2-deoxy-D(–) ribose and the sugar present in RNA is D (–)-ribose. The chirality of DNA and RNA molecules are due to the presence of sugar components.

(7) **(D).** Vitamin B is water soluble whereas all other are water insoluble.

(8) **(B).** In DNA; the complimentary bases are
Adenine - Thymine
and Guanine - Cytosine

(9) **(B).** Thyroxine is an amine hormone.

(10) **(B).** The segment of DNA which acts as the instrumental manual for the synthesis of the protein is gene.

(11) **(C).** Thyroxine is 3,5,3', 5'-tetra iodothryomine. It is secreted by follicular cells of thyroid glands.

(12) **(A).** Reducing sugars that exist in hemiacetal and hemiketal forms, undergo mutarotation in aqueous solution.
Among the given carbohydrates, only sucrose is a non-reducing sugar as in it the hemiacetal and hemiketal groups of glucose and fructose are linked together through O-atom and thus, not free. Due to the absence of free hemiacetal or hemiketal group, sucrose does not exhibit mutarotation.

(13) **(D).** In aqueous solution, fructose is enolised and then converted into aldehyde in basic medium. All aldehydes generally reduce Tollen's reagent, thus fructose also reduces Tollen's reagent.

(14) **(D).** (+) lactose is a reducing sugar and it exhibit mutarotation.

(15) **(A).** Vitamin B complex is fat insoluble

(16) **(C).** During denaturation secondary and tertiary structures of protein destroyed but primary structures remains intact.

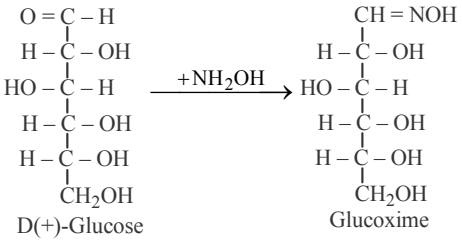
(17) **(D).** Enzymes are most reactive at optimum temperature.

(18) **(B).**

Deficiency diseases	**Vitamins**
Convulsions	B_6
Beri-Beri	B_1
Cheilosis	B_2
Sterility	E

(19) **(B).** Sucrose is a disaccharide of α-D-Glucopyranose and β-D-fructofuranose.

(20) **(D).** Glucoxime is formed.



(21) **(C).** Adrenaline hormone helps to release fatty acids from fat and glucose from liver glycogen under the condition of stress. It is also called 'flight or fight hormone.'

(22) **(C).** In a protein molecule, various amino acids are linked together by peptide bond.

(23) **(B).** The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose

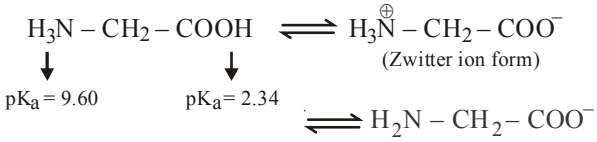
(24) **(D).** Sucrose is non-reducing sugar because reducing parts.

(25) **(C).** The central dogma of molecular genetics states that the genetic information flows from
DNA → RNA → Proteins

(26) **(D).** D-erythrose, D-threose, L-erythrose, L-threose.

(27) **(C).** Denaturation makes the protein more active.

(28) **(D).**

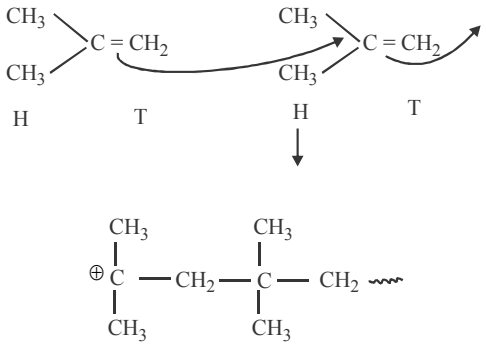


(29) **(C).** Amylose and Amylopectin are polymers of α-D-glucose, so β-link is not possible. Amylose is linear with 1 → 4 α-linkage whereas Amylopectin is branched and has both 1 → 4 and 1 → 6 α-linkages. So option (C) should be the correct option.

(30) **(C).**

PART - B (POLYMERS)

(1) **(A).** 2-methyl propene shows cationic polymerisation.



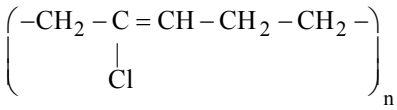
(2) **(D).** The given compound is a copolymer of hexamethyline diamine and adipic acid. It is actually Nylon-66.

(3) **(D).** Copolymer of adipic acid (6C) and hexamethylene diamine (6C).

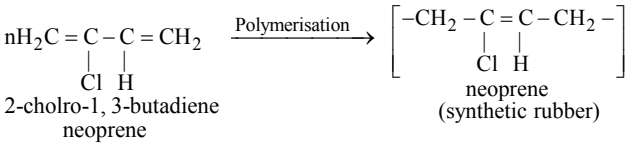
It has high tenacity and elasticity. It is resistant to abrasion and not affected by sea water. It is used for reinforcement of rubber tyres, manufacture of parachute, safety belts, carpets and fabrics.

(4) **(C).** Natural rubber has cis configuration at every double.

(5) **(A).** Correct representation is



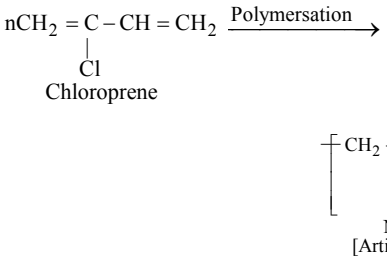
(6) **(A).** Neoprene (synthetic rubber) is a polymer of chloroprene (2-chloro -1, 3- butadiene).



(7) **(B).** Terylene is a polyester polymer because it is formed by the monomer units terephthalic acid and ethylene glycol.

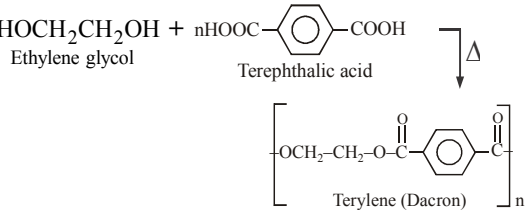
(8) **(D).** Nylon has polyamide linkage. It is formed by condensation reaction of amines and carboxylic acid groups.

(9) **(D).**

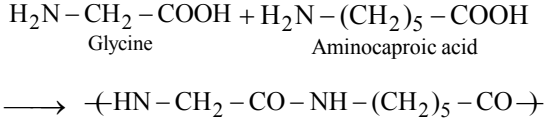


(10) **(D).** (A) Neoprene rubber (elastomer)
(B) PVC (thermoplastic polymer)
(C) Nylon-6, 6 (fibre)
(D) Novolac which further undergoes cross linking to produce bakelite (thermosetting polymer).

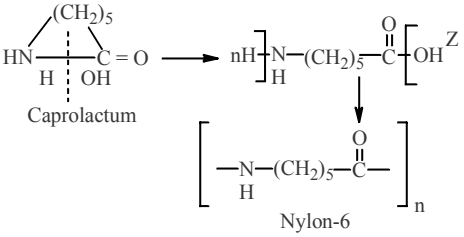
(11) **(C).**



(12) **(D).**

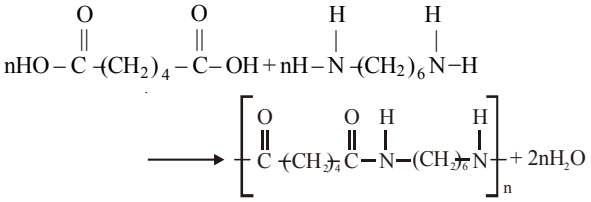


(13) **(C).**



(14) **(A).**

(15) **(D).** Nylon-6,6 is the co-polymer of adipic acid and hexamethylene diamine.



(16) **(D).** Cross linked or network polymers are formed from bi-functional and tri-functional monomers and contain strong covalent bonds between various linear polymer chains, e.g. bakelite, melamine etc. Option (D) is not related to cross-linking. So option (D) should be the correct option.

(17) **(B).** Nylon-2-Nylon 6.

PART C (CHEMISTRY IN EVERYDAY LIFE)

(1) **(D).** Equanil is used for the treatment of stress, mild and severe mental diseases i.e., as a tranquilizer.

(2) **(B).** Tranquilizer are the chemicals that reduce anxiety and mental tension. Thus, they are sometimes called psychotherapeutic drugs. Equanil, valium and serotonin are some commonly used transquilizers.

(3) **(C).** Diphenyl hydramine is employed as Antihistamine

(4) **(D).** Chloroamphenicol is a broad spectrum antibiotic.

(5) **(D).**

(6) **(C).** Aspartame is stable under cold condition but unstable at cooking temperature.

(7) **(C).** Bithional is added to soap as an antiseptic.

(8) **(A).** Novalgin is an analgesic.

(9) **(A).** Antiseptic (dettol)

(10) **(A).**