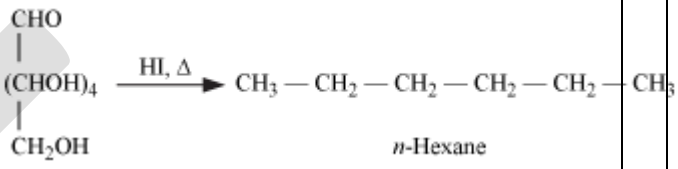
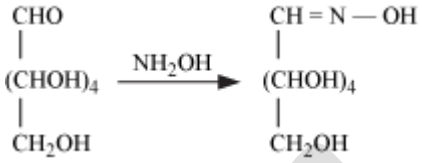
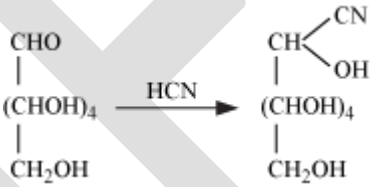
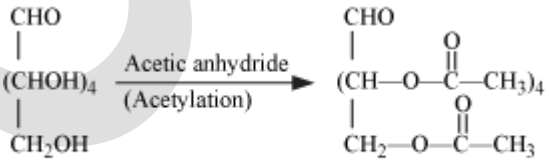
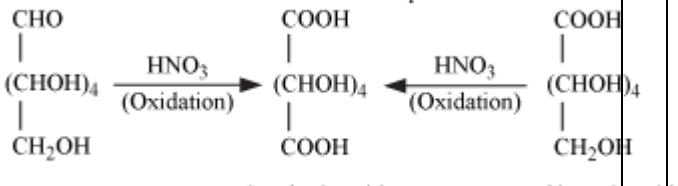
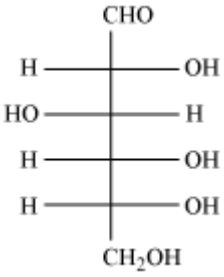
Unit 14
BIOMOLECULES

1	What are carbohydrates? Give examples	2
	Carbohydrates are polyhydroxy aldehydes or ketones or the substances which gives these upon hydrolysis. Example: glucose fructose maltose lactose sucrose starch cellulose glycogen etc.	
2	How are carbohydrates classified?	3

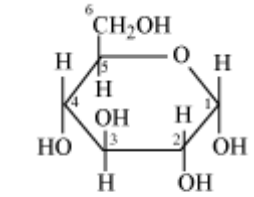
	Carbohydrates												
Reducing sugars	Sugars												Non sugars
Non reducing sugars													
Aldoses	Mono saccharaides				Oligo saccharides								Poly sacchrides
Ketoses													
	Trioses	Tetroses	Pentoses	Hexoses	di	tri	tetra	penta	hexa	hepta	octa	nano	deca

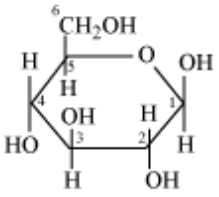
3	What are sugars and non-sugars?	2
	Sugars are the carbohydrates; soluble in water crystalline in nature and sweet in taste Example glucose fructose maltose lactose etc. non-sugars are carbohydrates; insoluble in water, amorphous in nature and tasteless. Example :starch cellulose glycogen etc.	
4	What are reducing sugars? Give example	2
	The sugars which can reduce Tollen's reagent, Benedict's reagent and Fehling's reagent are reducing sugars. These contain a free hydroxyl group on anomeric carbon. Example glucose fructose maltose lactose	
5	What are non-reducing sugars? Give example (Is sucrose a reducing sugar or not? Give reason.)	2
	The sugars which cannot reduce Tollen's reagent, Benedict's reagent and Fehling's reagent are non-reducing sugars. These do not contain a free aldehydic group(aldehydic groups are bonded). Example : sucrose	
6	What are monosaccharaides? Give examples	2
	Monosaccharaides are the simple sugars which do not undergo hydrolysis. Example : glucose fructose, Galactose	
7	What are oligosaccharides? Give examples	2
	Oligosaccharides are the sugars which undergo hydrolysis to give 2 to 10 monosaccharaide units. Example: maltose lactose sucrose etc.	
8	What are disaccharides? Give examples	2
	Disaccharides are the sugars which undergo hydrolysis to give 2 monosaccharaide units. Example: maltose lactose sucrose etc.	
9	What are polysaccharides? Give examples	
	Polysaccharides are the carbohydrates which undergo hydrolysis to give more than 10 (many) monosaccharaide units. Example: starch, cellulose, glycogen etc.	
10	Give an example of aldohexose	1
	Glucose or Galactose	

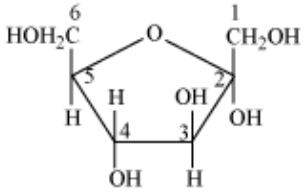
11	Give example of ketohexose	1
	Fructose	
12	How is glucose prepared?	2
	$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$ Sucrose Glucose Fructose $(C_6H_{10}O_5)_n + nH_2O \xrightarrow[393K,2-3atm]{H^+} nC_6H_{12}O_6$ Starch or cellulose Glucose	
13	Elucidate the structure of glucose	5
	(i) Molecular formula – $C_6H_{12}O_6$ (ii) Suggestion of straight chain  *n*-Hexane (iii) Confirmation of carbonyl (> C = O) group   (iv) Confirmation of the presence of carbonyl group as aldehydic group  Gluconic acid (v) Confirmation of the presence of five −OH groups  Glucose penta-acetate (vi) Indication of the presence of a primary alcohol  Saccharic acid Gluconic acid The correct configuration of glucose is given by  Kiliyanissyntesis	
14	Gluconic acid on oxidation with HNO_3 gives saccharic acid. What does it indicate about the structure	1

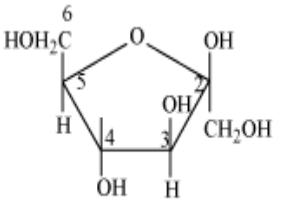
	of glucose?	
	Confirmation of the presence of primary alcoholic group	
15	Mention the structural features of open chain structure of glucose	2
	It has 1 aldehyde group, 1 primary alcohol group and 4 secondary alcoholic groups	
16	Mention the structural features of open chain structure of fructose	2
	It has 1 ketone group, 2 primary alcohol group and 3 secondary alcoholic groups	
17	Mention demerits of open chain structure of glucose	3
	The following reactions of glucose cannot be explained by its open-chain structure. 1. Aldehydes give 2, 4-DNP test, Schiff's test, and react with $NaHSO_4$ to form the hydrogen sulphite addition product. However, glucose does not undergo these reactions. 2. The penta-acetate of glucose does not react with hydroxylamine. This indicates that a free −CHO group is absent from glucose. 3. Glucose exists in two crystalline forms, α and β.	
18	How do you explain the absence of aldehyde group of the pentaacetate of D – glucose?	2
	The aldehyde group is involved in formation of cyclic hemiacetal with secondary alcoholic group of 5^{th} carbon. In pentaacetate of D – glucose, all 5 -OH groups are acetylated, therefore, it does not form an open chain structure, and does not react with NH_2OH. This fact indicates absence of aldehyde group in glucose. But, D-glucose reacts with hydroxylamine (NH_2OH) to form an oxime because of the presence of aldehydic (−CHO) group or carbonyl carbon. This happens as the cyclic structure of glucose forms an open chain structure in an aqueous medium, which then reacts with NH_2OH to give an oxime.	
19	What is glycosidic bond / linkage?	1
	Glycosidic linkage − Linkage between two monosaccharide units through oxygen atom	
20	Name the sugar present in cane sugar	1
	Sucrose	
21	What are the expected products of hydrolysis of sucrose	1
	α –glucose and β - fructose	
22	What are the expected products of hydrolysis of lactose	1
	B – Galactose and β- glucose	
23	Name the sugar present in milk sugar	1
	Lactose	
24	Name the components of starch	1
	Amylose and amylopectin	
25	Name water soluble component of starch	1
	Amylose	
26	Name water insoluble component of starch	1
	Amylopectin	
27	Name the storage polysaccharide in plants	1

	Starch	
28	Name the storage polysaccharide in animals	1
	Glycogen(animal starch)	
29	Name the structural polysaccharide in plants	1
	cellulose	
30	Write Haworth structure for α glucose / monomer in cellulose. (β glucose) / α fructose /β fructose	2


α – D – (+) – Glucopyranose

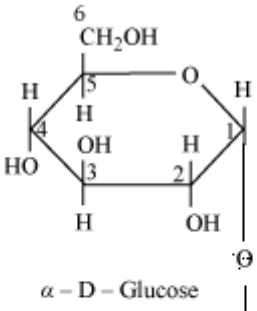

β – D – (+) – Glucopyranose

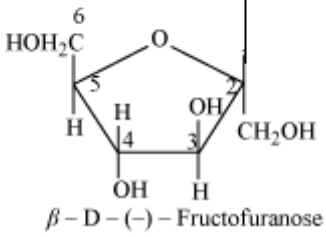

α – D – (–) – Fructofuranose


β – D – (–) – Fructofuranose

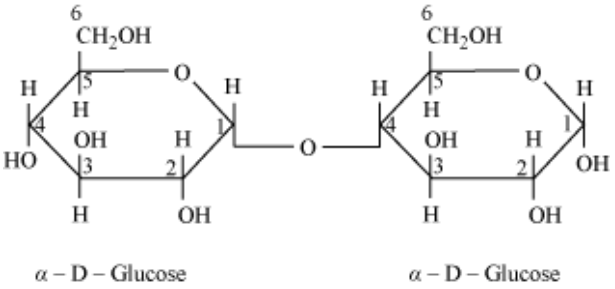
31	Write Haworth structure of sucrose/ maltose / lactose	2

Structure of sucrose:

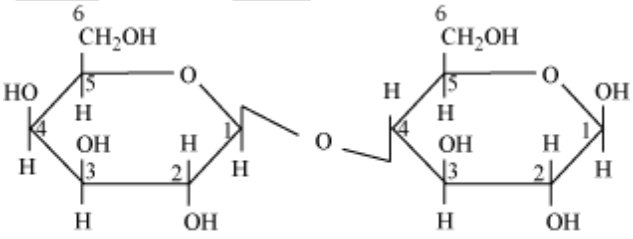

α – D – Glucose


β – D – (–) – Fructofuranose

Structure of Maltose:


α – D – Glucose α – D – Glucose

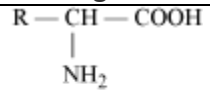
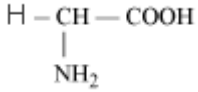
Structure of Lactose

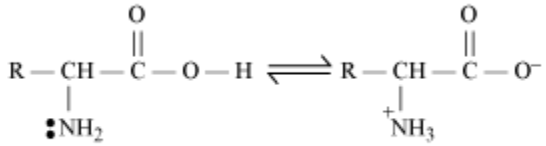
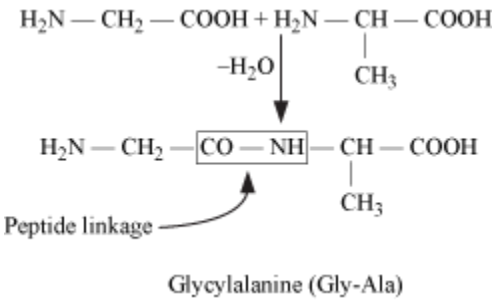

β – D – Galactose β – D – Glucose

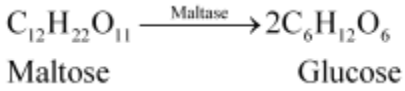
32	Why cellulose cannot be used as food by human beings?	1
	Human saliva do not contain the enzyme that can hydrolyses β 1-4 linkages present in cellulose	
33	What is glycogen? How does it differ from starch	3

Glycogen is a polymer of α – glucose linked by α 1-4 glycosidic bond and α 1-6 glycosidic bond at the point of branching

starch	glycogen
Storage polysaccharide in plants	Storage polysaccharides in animals
Made of two compenents 1) amylose 2)	Made of one component

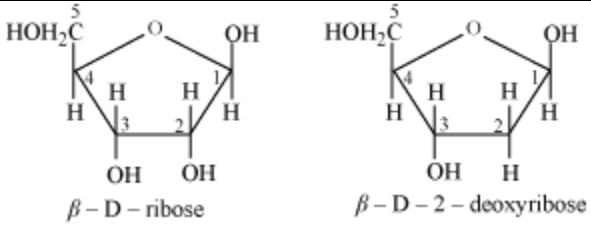
	amylopectin	
	Amylopectin has branched structure. The frequency of branching is at every 30 glucose units	Glycogen has branched structure. The frequency of branching is at every 10 glucose units
34	Mention two differences between starch and cellulose	2
	starch	cellulose
	Storage polysaccharide in plants	Structural polysaccharides in plants
	Made of two compenents 1) amylose 2) amylopectin	Made of one component
	Amylose is linear chain of α – glucose linked by α 1-4 glycosidic bond Amylopectin has branched structure. The frequency of branching is at every 30 glucose units	cellulose is linear chain of β – glucose linked by β 1-4 glycosidic bond
35	Name the products obtained when proteins are hydrolysed? What do you understand by this reaction?	2
	Proteins upon hydrolysis form amino acids. This indicates that proteins are made of amino acids	
36	What are amino acids? How many naturally occurring amino acids are present in proteins	2
	These are the organic compounds containing both amino and carboxyl group on α carbon atom. These are the building blocks(monomers) of proteins. There are 20 naturally occurring amino acids	
37	Write the general structure of amino acids	1
	 α-Amino acid (R= side chain)	
38	Write the structure of an optically inactive aminoacid	1
		
39	Name an amino acid containing sulphur	1
	Cysteine ,methionine	
40	Name an amino acid which is acidic	1
	Aspateric acid, Glutamic acid	
41	Name an amino acid which is basic	1
	Glutamine,Lysine	
42	Name an amino acid which contains heterocyclic nucleus	1
	Proline,histidine	
43	How amino acids are classified based on dietary requirement?	2
	Based of dietary requirement they are classified into essential and Non-essential amino acids:	

	Essential amino acids: Amino acids that cannot be synthesised in the body, and must be obtained through diet Example − Valine, leucine, isoleucine Non-essential amino acids: Amino acids that can be synthesised in the body Example − Glycine, alanine, glutamic acid Non-essential amino acids:	
44	What is zwitter ion? Write its general structure	2
	These are the amino acid dipolar ions, carrying both positive and negative charges. These moves neither towards cathode nor towards anode in electric field  (Zwitter ion)	
45	What is isoelectric point	1
	The pH at which amino acids acts as zwitter ions in aqueous solution is called isoelectric pH / point	
46	What is peptide bond? How is it formed?	2
	It is the amide bond present between two amino acids units in peptides and protein. It is formedby eliminating on molecule of water from α−COOH group and α $-NH_2$ group of two amino acid  Glycylalanine (Gly-Ala)	
47	What is poly peptide?	1
	Poly peptides are the polymers of (n)amino acids containing 10 to 50 amino acids in chain linked by (n-1) peptide bonds	
48	How many peptide bonds are present in a pentapeptide?	
	4	
49	What are proteins?	1
	proteins' are the polymers of (n)amino acids containing more than 50 amino acids in chain linked by (n-1) peptide bonds	
50	Name a hormone which controls the carbohydrate metabolism.	1
	insulin	
51	How are proteins classified based on their molecular shape and solubility?	3
	Based on the molecular shape, proteins are classified into two types Fibrous proteins, polypeptide chains run parallel and are held together by hydrogen and disulphide bonds. These are insoluble in water. These are also called structural proteins Example: keratin (hair and nail), actin and myosin (muscles) and collagen(cartilage) Globular proteins In Polypeptide chains coil around, giving a spherical shape. These are soluble in	

	water. These are also called functional proteins. Example: albumin, globulin etc	
52	Write a note on structure of proteins	4
	Structures and shapes of proteins are studied at four different levels: primary, secondary, tertiary and quaternary. Primary structure of proteins: Contains one or more polypeptide chains, and each chain has amino acids linked with each other in a specific sequence. This sequence of amino acids represents the primary structure of proteins. Secondary structure of proteins: Shape in which a long polypeptide chain can exist; two types of secondary structures: *α*-helix, *β*-pleated sheet, stabilised by hydrogen bonds α- Tertiary structure of proteins: Overall folding of the polypeptide chains; results in fibrous and globular proteins; secondary and tertiary structures of proteins are stabilised by hydrogen bonds, disulphide linkages, van der Waals forces and electrostatic forces. Quaternary structure of proteins: Spatial arrangement of subunits, each containing two or more polypeptide chains	
53	What is denaturation of proteins?	2
	Denaturation means loss of biological activity of proteins due to the unfolding of globules and uncoiling of helix. Denaturation takes place due to action of heat, addition of electrolytes etc Example − Coagulation of egg white on boiling, curdling of milk	
54	What are enzymes? Give example	2
	Enzymes are biocatalysts. Specific for a particular reaction and for a particular substrate  $C_{12}H_{22}O_{11} \xrightarrow{\text{Maltase}} 2C_6H_{12}O_6$ Maltose Glucose For example, maltase catalyses hydrolysis of maltose	
55	What are vitamins? How are these classified?	3
	Vitamins are micronutrients that take part in metabolic process, to produce energy and growth. These are classified as water soluble vitamins (vitamin B complex and vitamin C). fat soluble vitamins (vitamin A,D,K,E,)	
56	Mention the source and deficiency syndrome of vitaminA	1
	Sources: Fish liver oil, carrots, butter and milk Deficiency diseases: Xerophthalmia, night blindness	
57	Mention the source and deficiency syndrome of Vitamin B_{12}	1
	Sources: Meat, fish, egg and curd Deficiency diseases: Pernicious anaemia	
58	Mention the source and deficiency syndrome of Vitamin C	1
	Sources: Citrus fruits, *amla* and green leafy vegetables Deficiency diseases: Scurvy	
59	Mention the source and deficiency syndrome of Vitamin D	1
	Sources Deficiency diseases	

	Exposure to sunlight, fish and egg yolk — Rickets and osteomalacia	
60	Name the products when nucleic acids are hydrolysed step wise	2
	Nucleic acids → nucleotides Nucleotides → nucleosides + phosphoric acid Nucleosides → pentose sugar + heterocyclic bases (purine and pyrimidine)	
61	How nucleoside and nucleotide are formed?	2
	1) Nucleoside is formed when N-base gets attached to 1 position of pentose sugar. N-base + Pentose sugar $\longrightarrow$ nucleoside 2) Nucleotide is formed when nucleoside is linked to phosphoric acid at 5^{th} position of pentose sugar. Nucleoside + H_3PO_4 $\longrightarrow$ nucleotide	
62	What are nucleic acids?	1
	Nucleic acids are the polymers of nucleotides linked by 3-5 phosphodiester bond	
63	What are the differences between DNA and RNA	3

DNA	RNA
Contains de- oxy ribose sugar	Contains ribose sugar
Bases are A,G,C,T	Bases are A.G.C.U
Has double helical structure	Has single stranded structure
Present in nucleus of the cell	Present in cytoplasm
Hereditary material	Involved in protein synthesis • Messenger RNA (m-RNA) • Ribosomal RNA (r-RNA) • Transfer RNA (t-RNA)

64	Name a. The sugar moiety present in DNA b. Nitrogenous base present only in DNA, but not in RNA.	
	a) de- oxy ribose sugar b)Thymine	
65	Write the structure of ribose sugar / deoxy-ribose sugar	2
	 β – D – ribose β – D – 2 – deoxyribose	
66	Name any 3 Biological functions of nucleic acids	3
	1. DNA is chief chemical as reserve genetic information. 2. DNA is chiely responsible for identity of a species. 3. DNA is capable of self replication during cell division. 4. Important function of RNA is in protein synthesis in the cells. Message for the protein synthesis is in DNA but various RNAs take part in protein synthesis.	
67	What are hormones? Give an example for each type of hormone	

	a) Polypeptide hormones b) Amino acid derivatives c) Steroid hormones	
	Hormones are biochemical messengers produced by endocrine glands. a) Polypeptide hormones ----- insulin/ glucagons b) Amino acid derivatives----- Thyroxine/Epinephrine c) Steroid hormones--- Testosterone/Estradiol/progesterone	
68	Write the function of the following hormones : a) Insulin b) Thyroxine c) Estrogen and androgen	
	a) Insulin: Maintains blood sugar level b) Thyroxine: Growth and development c) Estrogen and androgen: Development of secondary sex characters	