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CURRENT FILE BIO202
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Effort by champions

CARBOHYDRATES

1. Monosaccharide (5 mark)

Monosaccharides (simple sugars) are those which cannot be hydrolyzed further into simpler forms the backbones of common monosaccharides are unbranched carbon chains in which all the carbon atoms are linked by single bonds. In the open-chain form, one of the carbon atoms is double-bonded to an oxygen atom to form a carbonyl group. Each of the other carbon atoms has a hydroxyl group. If the carbonyl group is at an end of the carbon chain (that is, in an aldehyde group) the monosaccharide is an aldose If the carbonyl group is at any other position (in a ketone group) the monosaccharide is a ketose. Ribose, Glucose and Fructose
The simplest monosaccharides are the two three-carbon trioses:

- Glyceraldehyde,an aldotriose
- Dihydroxyacetone,a ketotriose

2. Hydrolysis products name for sucrose maltose Lactose 3 marks

Disaccharides are those sugars which yield two molecules of the same or different monosaccharides on hydrolysis

- Maltose - 2 molecules of glucose on hydrolysis
- Lactose – 1 glucose & 1 galactose on hydrolysis
- Sucrose – 1 glucose & 1 fructose on hydrolysis

3. How many numbers of carbon atom in nucleotide and nucleosides

A nucleotide is composed of three distinctive chemical sub-units: a five-carbon sugar molecule, a nucleobase—the two of which together are called a nucleoside—and one phosphate group

4. Function of dehydrogenase and protease (2)

Dehydrogenases remove hydrogen atoms
Proteases hydrolyze proteins

5. Epimers with two examples (2)

Two sugars which differ from one another only in configuration around a single carbon atom are termed epimers. Glucose and Galactose are an example of an epimeric pair which differs only with respect to C4. Similarly Glucose and mannose are epimers with respect to C2

6. Calculate p1 of glutamate? (3)

Glutamate has a pI of 3.22, considerably lower than that of glycine. This is due to the presence of two carboxyl groups, with an average of their pKa values of 3.22

7. Pentose sugar type

Pentose Sugar
D-ribose and 2-deoxy D-ribose are the only sugars so far found in the nucleic acids.
These aldo pentoses belong to D-family. They are present as Furanose (ring) in the form of β-Anomer. The addition of a pentose sugar to a base produces a nucleoside. If the sugar is D-

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ribose, a ribonucleoside is produced. If the sugar is 2-deoxy D- ribose, a deoxyribonucleoside is produced

8. Osazones and its formation

Preparing crystalline derivatives of sugars called osazones
They are obtained by adding a mixture of phenyl hydrazine hydrochloride and sodium acetate to a sugar solution and heating in water bath for 45 mins. Crystals are formed after the solution is cooled slowly. Reaction involves only the carbonyl carbon and the adjacent carbon. First phenyl hydrazone is formed and then reacts with an additional molecule of phenylhydrazine to form the osazones.

9. Difference between aldo and keto sugar? (2)

An aldose is defined as a monosaccharide whose carbon skeleton has an aldehyde group. They are primarily found in plants. Ketose is a monosaccharide whose carbon skeleton has a ketone group. Only in the presence of reducing sugar, they can isomerize to aldose.

10.N-glycosidic bond.5

Sugars are linked to the heterocycle by a β -N-glycosidic bond, almost always to the N-1 of a pyrimidine and N-9 of a purine. The N-glycosyl bond is formed by removal of the elements of water a hydroxyl group from the pentose and hydrogen from the base. Thus it is a condensation reaction. Similar to O-glycosidic bond formation in carbohydrates. However N-glycosidic bonds, have Nitrogen atom instead of oxygen linking the two residues.

11.L fucose and L rahmnose

L fucose is found in the complex oligosaccharide component of glycoprotein and glycolipid rhamnose is found in plant poly saccharide

12.Pentose bases and its characteristics

Pentose any of the class of simple sugars whose molecules contain five carbon atoms, such as ribose and xylose. They generally have the chemical formula C5H10O5.
Adenine when combines with pentose the structure is known as Adenosine or deoxyadenosine. Adenine is 6-aminopurine
Guanine when combines with pentose the structure is known as Guanosine or deoxyguanosine. Guanine is 2-amino,6-hydroxypurine
Minor Purine Bases: Inosine (I) & methyl guanine (7mG)
Unnatural: Mercaptopurine, Allopurinol & 8-Azaguanine
Other purines include: hypoxanthine and xanthine
Uric acid is the catabolic end product of purines in human beings

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NUCLEOTIDES

13.Phosphodiestr bond formation 2 marks

When two or more nucleotides combine together a phosphodiester bond is formed. This bond is formed mainly between the 3´OH group of sugar of one nucleotide and 5´PO4 group of sugar of another nucleotide creating a phosphodiester linkage.
By definition, the 5´ end lacks a nucleotide at the 5´ position and the 3´ end lacks a nucleotide at the 3´ position. The sugar and phosphate group is called the backbone of the nucleic acid. The backbones of both DNA and RNA are hydrophilic.

14.Types of phosphatases? (2)

Two types of phosphatases in the body

- The one that acts in the alkaline pH is called alkaline phosphatase and
- The other which acts at acidic pH is known as acid phosphatase.

15.Type of phosphate bond?

There may be one, two, or three phosphate groups present in nucleotides.

- Nicotinamide adenine dinucleotide phosphate.
- Phosphoproteins.
- Adenosine triphosphate.
- Dihydrogen phosphate.

16.Nucleotide composition

- A nitrogenous base (purine or pyrimidine)
- A pentose monosaccharide
- One, two, or three phosphate groups

Nitrogenous Bases

The nitrogen-containing bases belong to two families of compounds:

Purines and Pyrimidines

By the attachment of different groups to the rings, different types of pyrimidine and purine are generated.

17.Five nitrogen bases 5 marks

The nitrogen-containing bases belong to two families of compounds:

- Purines
- Pyrimidine

Purines

In which include: Adenine (A) and Guanine (G)

- Adenine when combines with pentose the structure is known as Adenosine or deoxyadenosine Guanine when combines with pentose the structure is known as Guanosine or deoxyguanosine Adenine is 6-aminopurine
- Guanine is 2-amino,6-hydroxypurine
- **Minor Purine Bases:** Inosine (I) & methyl guanine (7mG)
- **Unnatural:** Mercaptopurine, Allopurinol & 8-Azaguanine
- **Other purines include:** hypoxanthine and xanthine

Pyrimidines:

Pyrimidines include: Cytosine (C)—in
DNA and RNA, Thymine (T)—only in DNA and Uracil (U) —only in RNA

- Cytosine when combines with pentose it becomes deoxycytidine and cytidine
- Thymine becomes thymidine and deoxythymidine
- Uracil (U) becomes uridine and deoxyuridine depending on the type of sugar.
- Cytosine is 2-oxy-4-amino-pyrimidine
- Thymine is 2, 4-dioxy-5-methyl-pyrimidine
- Uracil is 2, 4-dioxy-pyrimidine
- T and U differ by only one methyl group, which is present on T but absent on U

Minor Pyramidine Bases: Dihydrouridine (DHU), 5-Methyl Cytadine & 5-Hydroxy-Methyl Cytadine

Unnatural Pyramidine Bases: Fluorouracil (5FU) & 6-Aza Cytosine (AZC)

18.Reactions of Xanthine oxidase.

Xanthine oxidase is a form of xanthine oxidoreductase, an enzyme that generates reactive oxygen species such as superoxide radicals and hydrogen peroxide when it catalyzes the

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oxidation of hypoxanthine to xanthine, and can further catalyze the oxidation of xanthine to uric acid.

19.Nucleotide and nucleoside

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

A nucleotide consists of a nitrogenous base, a sugar (ribose or deoxyribose) and one to three phosphate groups

20.medical importance of nucleotides and nucleic acids

- Transmission of genetic information
- This gives them the ability to store and transmit genetic information from one generation to the next
- Protein synthesis
- Nucleotides play an important role as "energy currency" in the cell.
- Nucleoside tri- and diphosphates such as ATP and ADP are the principal donors and acceptors of phosphoryl group in metabolism.
- By doing this, they play a key role in the energy transduction.

Nucleotides also serve as carriers of activated intermediates in the synthesis of some carbohydrates, lipids, and proteins

21.Components of nitrogenous bases

Nitrogenous bases present in the DNA can be grouped into two categories: purines (Adenine (A) and Guanine (G)), and pyrimidine (Cytosine (C) and Thymine (T)). These nitrogenous bases are attached to deoxyribose through a glycosidic bond. Deoxyribose attached to a nitrogenous base is called a nucleoside.

22.Unusual natural bases name2

The tRNA molecules contain not only the usual bases like adenine, guanine, cytosine, uracil but also contain unusual bases. These unusual bases (also called modified bases) include: Dihydrouracil, Pseudouridine and Thymine.

23.Difference b/w Adenocine and gaunosine?

- Adenine when combines with pentose the structure is known as Adenosine or deoxyadenosine
- Guanine when combines with pentose the structure is known as Guanosine or deoxyguanosine
- Adenine is 6-aminopurine
- Guanine is 2-amino,6-hydroxypurine

24.Nucleotides s energy currency 5 marks

Energy currency: Nucleotides play an important role as "energy currency" in the cell. Nucleoside tri- and diphosphates such as ATP and ADP are the principal donors and acceptors of phosphoryl group in metabolism. By doing this, they play a key role in the energy transduction. This energy is used in almost every energy requiring process in the body, such as; Muscle contraction, Transmission of nerve impulse, Transports of nutrients across cell membrane Motility of spermatozoa And many more energy dependent processes

25.Diff b/t thymine and uracil.2

Thymine becomes thymidine and deoxythymidine. Thymine is 2, 4-dioxy-5-methyl-pyrimidine. Present in DNA

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Uracil (U) becomes uridine and deoxyuridine depending on the type of sugar. Uracil is 2,4-dioxy-pyrimidine. Present in RNA

26.DNA groove

Grooves: The spatial relationship between the two strands in the helix creates
A major (wide) groove and a minor (narrow) groove. These grooves provide access for the binding of regulatory proteins to their specific recognition sequences along the DNA

27.Interaction of DNA?

Stacking Interaction: Hydrophobic stacking interactions in which two or more bases are positioned with the planes of their rings parallel (like a stack of coins) are one of two important modes of interaction between bases in nucleic acids. The stacking also involves a combination of van der Waals and dipole-dipole interactions between the bases.

28.Coding of RNA 10 mark

The three-dimensional structures of many RNAs, like those of proteins, are complex and unique.

Primary Structure of RNA

It is defined as the number and sequence of ribonucleotides in the RNA chain. The sequence is complementary to the template strand of the gene from which it was transcribed.

- Template strand, the sequence of DNA that is copied
- Non Template (coding strand):

The ribonucleotides are held together by 3′- 5′ phosphodiester bonds. • 3′-OH group of one nucleotide is bound to 5′-PO4 of the other nucleotide and form a linear strand

Secondary structure

Secondary structure involves coil formation of the polyribonucleotide chain. The coiled structures are stabilized by hydrophobic interactions between purine and pyrimidine bases.Intra-chain hydrogen bonds between G-C and A-U.
Where complementary sequences are present, the predominant double-stranded structure is formed.

- **Internal loops:** a short series of unpaired bases in a longer paired helix and
- **bulges:** regions in which one strand of a helix has "extra" inserted bases with no counterparts in the opposite strand

Tertiary Structure of RNA

It is the folding of the molecule into three dimensional structures. Cross-linking at various sites stabilized by hydrophobic and hydrogen bonds produce a compactly coiled globular structure.
The stacking of helices, together with specific helix–helix contacts or helix–loop interactions, lead to compact tertiary structure of the RNA assemblies, generally in the presence of divalent ions or polyamines

29.RNA and its types.

RNA is a polymer of ribonucleotides of Adenine, Uracil, Guanine and Cytosine, joined together by 3′-5′phosphodiester bonds. And its types are t-RNA, m-RNA, r-RNA

30.What are Eicosanoids

Arachidonic acid is the precursor of paracrine hormones called Eicosanoids. Eicosanoids are chemical messengers which act over a short distance and include: Prostaglandins, Leukotrienes and Thromboxanes

31.Monoamino

A simple monoamino monocarboxylic - amino acid, such as alanine, is a diprotic acid when fully protonated—it has two groups, the-COOH group and the - NH3 + group, that can yield protons

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32.Alanine, lysine, arginine, histidine and isoleusine

Alanine shows the greatest tendency to form α helices in most experimental model systems.
Lysine, which has a second primary amino group at the ε position on its aliphatic chain
Arginine, which has a positively charged guanidinium group
Histidine, which has an aromatic imidazole group
Isoleucine is an essential amino acid. It may help how hemoglobin is made. This is the oxygen-carrying pigment inside of red blood cells. It may help control blood sugar

33.Differentiate between cis and trans conformation of peptide bond 2 marks

When double bonds are present, they are nearly always in the cis rather than in the Trans configuration. A cis configuration means that the two hydrogen atoms adjacent to the double bond stick out on the same side of the chain

34.Pleated sheet and it's types

A regular element of secondary structure in proteins, in which two or more extended strands of the polypeptide chain lie side by side is called pleated sheet. Two types are parallel and anti-parallel
The -pleated sheet is described as polypeptide strands parallel if the run in the same direction (as defined by their amino and carboxy terminals) and anti-parallel if they run in opposite direction

35.Protein folding 3 marks

Protein folding is the process by which a protein structure assumes its functional shape or conformation. It is the physical process by which a polypeptide folds into its characteristic and functional three-dimensional structure from random coil. A protein is called a native protein if its amino acid composition and molecular conformation are unchanged from that found in natural states. The three dimensional structure must have an external surface for its environment.

- In the first stage, as the newly synthesized polypeptide emerges from the ribosome, short segments fold into secondary structural units.
- Then, each element of secondary or super-secondary structure proper folding by directing the folding process.
- This step-wise folding of the proteins is dictated by thermodynamics resulting in a formation of native form.

36.How hydrophobic and disulfide bridge help in tertiary structure of protein

❖ Disulfide bond

The amino acid cysteine in a protein can form a covalent disulfide bond with another cysteine molecule through spontaneous oxidation of their sulfhydryl groups.

❖ Hydrogen bonds

Hydrogen bonds in which a hydrogen atom is shared by a nitrogen (or oxygen) in the peptide backbone and an oxygen atom in an amino acid side chain.

37.Hydrophobic interaction

Hydrophobic Interactions occur between non-polar uncharged side chains such as between aromatic groups of phenylalanine side chains.

38.Misfolding of protein

Despite the many processes that assist in protein folding, misfolding does occur. Misfolding of proteins may occur spontaneously, or caused by a mutation in a particular gene, producing an

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altered protein. Alzheimer's disease • Type 2 diabetes, • Huntington's disease and • Parkinson's disease, arise from a common misfolding mechanism

39.How low stable region affect protein.3

It has regions of high and low stability; variations in the stability of regions within a protein are often essential for protein to function. The regions of low stability allow a protein to alter its conformation between two or more states, such as an inactivated and activated enzyme.

40.histones and it's type (2)

Eukaryotic DNA is associated with tightly bound basic proteins, called histones. There are five classes of histones, designated H1, H2A, H2B, H3, and H4.

41.Define Tm and its concentration

Tm: When DNA is heated, the temperature at which one half of the helical structure is lost is defined as the melting temperature.

Factors affecting Tm

The Tm is influenced by

- Base composition of the DNA
- The salt concentration of the solution
- The higher the content of GC base pairs, the higher the melting point of the DNA.

This is because GC base pairs, with three hydrogen bonds, require more heat energy to dissociate than AT base pairs.

Salt concentration of TM

- An increase in salt concentration increases and a
- Decrease in salt concentration decreases the Tm

42.Define isomerism and classification

The existence of two or more compounds having the same molecular formula but a different arrangement of atoms within the molecule

Classification

Isomers divide neatly in to two categories:

- Constitutional isomers (different connectivity)
- Stereoisomers (same connectivity, different arrangement in space) in which:
  - Diasteromers in which cis/trans isomers
  - Enantiomers

43.Explain Hsp60?

The hsp60 family of chaperones sometimes called chaperonins, differ in sequence and structure from hsp70 and its homology. Hsp60 acts later in the folding process, often together with an hsp70 chaperone. Hsp60 chaperonins form a multi-subunit barrel-shaped structure • The unfolded protein fits into the barrel cavity that excludes water and serves as a template for the folding process. The Hsp60 class of protein has a barrel shape into which the protein fits. It acts as a template, binding and rebinding portions of the unfolded protein until folding is completed. It hydrolyzes many ATP bonds to provide energy for the process.

44.Positive cooperative and negative allotropy.

Binding of oxygen to facilitate other molecule of oxygen is called positive cooperativity. Whereas, binding of carbon dioxide and proton to release oxygen is called negative allostery, in which increased CO2 and H+ ion favor oxygen unloading.

45.Groups of histidine

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Histidine has an R group (pKa = 6.0) providing significant buffering power near the neutral pH usually found in the intracellular and extracellular fluids of most animals. Amino acids with heterocyclic R groups (such as histidine)

46.Cooperative binding

The binding of one molecule of O2 to hemoglobin enhances the ability of hemoglobin to bind more O2 molecules. • This property of hemoglobin is known as "cooperative binding."

47.Example of Condensed Reaction? (2)

In organic chemistry, a condensation reaction is a type of chemical reaction in which two molecules are combined to form a single molecule, usually with the loss of a small molecule such as water. If water is lost, the reaction is also known as a dehydration synthesis

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48.Lipid its properties and its classification

The lipids are a heterogeneous group of compounds, including fats, oils, steroids, waxes, and their derivatives

They have the common property

- Insoluble in water
- Soluble in nonpolar solvents such as ether and chloroform
- The biological functions of the lipids as their chemistry
- Fats and oils are the principal stored form of energy in many organisms
- Phospholipids and sterols are major structural elements of biological membranes.
- Adipose tissue Fat also serves as a thermal insulator in the subcutaneous tissues and around certain organs.
- Nonpolar lipids act as electrical insulators

Lipids are classified in following three major groups:

- Simple lipids
- Complex Lipids and
- Precursor and Derived Lipids

Simple lipids:

Esters of fatty acids with various alcohols these contain: Fats (and Oils) and Waxes
Fats: Esters of fatty acids with glycerol (Oils are fats in the liquid state)
Waxes: Esters of fatty acids with higher molecular weight monohydric alcohols.

Complex lipids:

Esters of fatty acids containing groups in addition to an alcohol and a fatty acid. These include: Phospholipids, Glycolipids and Other Complex lipids

- **Phospholipids:** Lipids containing, in addition to fatty acids and an alcohol, a phosphoric acid residue e) Phospholipids frequently have nitrogen containing bases and other substituent: Glycerophospholipids the alcohol is glycerol. Sphingophospholipids the alcohol is sphingosine.
- **Glycolipids (glycosphingolipids):** Lipids containing: fatty acid, sphingosine, and carbohydrate
- **Other complex lipids:** Lipids such as sulfolipids, aminolipids lipoproteins may also be placed in this category

Precursor and derived lipids:

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These include, fatty acids, glycerol, steroids, other alcohols, fatty aldehydes, ketone bodies, lipid-soluble and vitamins

49.Hypercholesterolemic

Hypercholesterolemia can be defined as the presence of high plasma cholesterol levels, with normal plasma triglycerides. Lauric (12:0), myristic (14:0), and palmitic (16:0) acids are considered to be hypercholesterolemic

50.Normal fatty acid chain

Most naturally occurring fatty acids have an unbranched chain of carbon atoms, with a carboxyl group (–COOH) at one end, and a methyl group (–CH3) at the other end. The position of the carbon atoms in the backbone of a fatty acid are usually indicated by counting from 1 at the −COOH end.

51.What are plasmalogens

Ether lipids with an unsaturated group (alkenyl) at the 1st position on the glycerol chain are called Plasmalogens

52.Bile salts

Bile salts (conjugated bile acids) are quantitatively the most important organic components of bile. The bile salts, act to break apart the fat globules in the small intestines and allow them to become more "soluble" for absorption. The emulsification of dietary fats in intestinal canal, brought about by bile salts, is a prerequisite for digestion and absorption of fats.

53.Iodine no. and importance

The number of grams of iodine which will be absorbed by 100 grams of a fat is termed its iodine number. Halogens such as chlorine, bromine and iodine can also be added to double bonds in unsaturated fatty acids. Degree of halogenation is a good index of degree of unsaturation of Fatty Acids

Importance:

The more the iodine number, the greater the degree of unsaturation. Fats rich in saturated fatty acids have low iodine numbers, while fats rich in unsaturated fatty acids have high iodine numbers. The determination of iodine number is useful to the chemist in determining the quality of an oil or its freedom from adulteration. The higher is the iodine number, the more reactive, less stable, more susceptible to oxidation and rancidification is the oil or fat.

54.Saponification number2 marks

The number of milligrams of the sodium hydroxide and potassium hydroxide of free or combined state of fats or wax to completely sponifying are called Saponification number. Hydrolysis of a fat by an alkali is called **saponification.** The resultant products are glycerol and the alkali salts which are called “soaps” The amount of alkali needed to saponify a given quantity of fat will depend upon the number of carboxylic (–COOH) group present. Thus fats containing short chain fatty acids will have more –COOH groups per gram than long- chain fatty acids and this will take up more alkali. And hence will have higher saponification number

55.Waxes and its types

Esters of fatty acids with higher molecular weight of monohydric alcohols. A second group of neutral lipids that are of physiological importance. Although they are a minor component of biological systems. Waxes are of two types:

- **True**

Waxes are solid simple lipids containing a monohydric alcohol (with a higher molecular weight than glycerol) esterified to long-chain fatty acids. In which include:

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- **Bees-wax**

It is secreted by the honeybees that use it to form the combs. It is a mixture of waxes chief constituent is myricyl palmitate

- **Spermaceti**

It is a wax that is most often found in the head cavities of the sperm whale. Fatty esters are formed essentially of

- cetyl palmitate
- cetyl myristate

It was used in cosmetics, pharmacy and also in candles. Recent international regulation concerning whale captures has stopped its use. It is now replaced by synthetic cetyl palmitate.

- **Other Waxes or Non true waxes**

Include esters of: Cholesterol, Vitamin A, and Vitamin D

Cholesterol esters: Lanolin (or wool fat) is secreted by sheep sebaceous glands and it contains both free and esterified cholesterol, e.g., cholesterol-palmitate. Lanolin secretion helps sheep in reducing water evaporation from the skin. It is used as industrial lubricant and in • cosmetics

56.Characteristics of palmitic acid.

Palmitic Acid (16:0) is most common saturated Fatty Acid found in animals, plants and microorganisms. Palmitic acid mainly occurs as its ester in triglycerides (fats), especially palm oil. It is also found in high amounts in Butter, Cheese, milk and meat. Excess carbohydrates in the body are converted to palmitic acid. • Palmitic acid is the first fatty acid produced during fatty acid synthesis. palmitic acid is a major body component of fats found in the animals.

57.Galactosylceramide

It is a major glycosphingolipid of brain and other nervous tissue, • It contains a number of characteristic C24 fatty acids, • eg, cerebronic acid

58.Globo-sides 3 marks

They are glycosphingolipids, with two or more sugars, D -glucose, D- galactose, or N-acetyl-D-galactosamine.

A glycosphingolipid that has only one sugar as the side chain is called a cerebroside, Globosides are highly abundant in RBCs and Globosides are also found in human serum, spleenand liver.

59.What is Sulfatides?

Sulfoglycosphingolipids (sulfatides) are cerebrosides that contain sulfated galactosyl residues, and are therefore negatively charged at physiologic pH. Sulfatides are found predominantly in nerve tissue and kidney

60.Hydrogenation 5 marks

- A hydrogenation reaction involves conversion of a carbon-carbon double bond to a carbon-carbon single bond through the addition of hydrogen Hydrogenation – As you continue to hydrogenate your molecule Melting point increases
- Fat becomes more solid at room temp
- Oils which are liquid at ordinary room temperature, hydrogenation become solidified
- This is the basis of Banaspti ghee manufacturing.
- Where inedible and cheap oils like cotton seed oil are hydrogenated and converted to edible solid fats.
- The hydrogenation is done under high pressure of hydrogen and is catalyzed by finely divided nickel or copper and heat.

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- It is the base of hardening of oils (margarine manufacturing), e.g. change of oleic acid of fats (liquid) into stearic acid (solid).
- Fats have lower melting points, stearic (SFA) melts at 70

61.Rancidity

It is a physico-chemical change in the natural properties of the fat leading to the development of unpleasant odor or taste or abnormal color. It occurs particularly on aging after exposure to atmospheric oxygen, light, moisture, bacterial or fungal contamination and/or heat. Saturated fats resist rancidity more than unsaturated fats that have unsaturated double bonds.

Rancidity is due to

- Oxidation
- Hydrolysis
- Oxidative Rancidity

Oxidation of the fat molecules gives rise to some short chain aldehydes, ketones and dicarboxylic acids. The oxygen of the air is necessary for this type of rancidity. This can be prevented by addition of anti-oxidants such as vitamin E to foods.

Hydrolytic Rancidity: It is due to the slow hydrolysis of fats, which in case of fats like butter results in the short chain fatty acids which are volatile and have rancid taste and odor

62.Steroil

A steroid is a lipid whose structure is based on the tetracyclic (four-ring) structure consists of 3 cyclohexane rings, 1 cyclopentane ring. Steroids with eight to ten carbon atoms in the side chain at C-17 and a hydroxyl group at C-3 are classified as sterols

63.Lipoprotein 5

A lipoprotein is a biochemical assembly whose primary function is to transport hydrophobic lipid (also known as fat) molecules in water, as in blood plasma or other extracellular fluids. They differ in lipid and protein composition, size, density and site of origin. Different combinations of lipids and proteins produce particles of different densities

Types are:

- chylomicrons (CM),
- very-low-density lipoproteins (VLDL),
- low-density lipoproteins (LDL),
- High-density lipoproteins (HDL).

Chylomicrons are formed and assembled in intestinal mucosal cells after a fatty meal. And carry dietary triacylglycerol, cholesterol, and cholesteryl esters to the peripheral tissues.

VLDLs are assembled in the liver, composed predominantly of TAGs synthesized in liver and contain some cholesterol and cholesteryl esters

Characteristics of VLDL

VLDL is made in the liver and is responsible for delivering triglycerides to cells in the body, which is needed for cellular processes. As triglycerides get delivered to cells, VLDL is made up less of fat and more of protein, leaving cholesterol on the molecule.

LDL particles contain much less triacylglycerol than their VLDL predecessors, and have a high concentration of cholesterol and cholesteryl esters. LDLs contain apoB-100 as their major apolipoprotein. They carry cholesterol to extra hepatic tissues that have specific plasma membrane receptors that recognize apoB-100.

HDL originates in the liver and small intestine as small, protein-rich particles that contain little cholesterol and no cholesteryl esters. They take up cholesterol from non-hepatic (peripheral)

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tissues and return it to the liver as cholesteryl esters. When cholesterol is taken up by HDL, it is immediately esterified and becomes hydrophobic

64.Explain hydrogenation of fatty acids?

Hydrogenation converts liquid vegetable oils into solid or semi-solid fats, such as those present in margarine. Changing the degree of saturation of the fat changes some important physical properties, such as the melting range, which is why liquid oils become semi-solid.

65.Role of tri-acyl-glycerides in plants 3 marks

Triacylglycerols are also stored as oils in the seeds of many types of plants. Thus providing energy and biosynthetic precursors during seed germination. Adipocytes and germinating seeds contain lipases, enzymes that catalyze the hydrolysis of stored triacylglycerols. Therefore releasing fatty acids for export to sites where they are required

66.Write advantage of tri-acylglycerol as store fuel?

The major advantage of lipid fuels e.g. fatty acids and lipid energy stores e.g. triacylglycerols are their energy density. Thus those forms of exercise with a long duration and a high total energy demand such as marathon running tend to use predominantly lipid fuels

12.Physical properties of tags 5

These are:

- **Neutral fats are**

colourless, odorless and tasteless substances

- **Solubility:**

They are insoluble in water but soluble in organic fat solvents (e.g., ether, benzene, acetone, chloroform)

- **Specific gravity:**

The specific gravity of all fats is less than 1.0, consequently all fats float in water

- **Emulsification:**

Emulsions of fat may be made by shaking vigorously in water and by emulsifying agents such as gums and soaps

67.Write three example of poly-unsaturated fatty acid?

This is found in sunflower, corn, soybean and cottonseed oils. It's also found in walnuts, pine nuts, flaxseed, and sesame, sunflower and pumpkin seeds. Omega-3s fall into this category and are found in fatty fish, such as salmon, herring and sardines.

68.Diseases caused due to omega 3 and omega 6.

Current evidence suggests that diet rich in omega 3 fatty acids are beneficial particularly for cardiovascular disease and also to some extent for Alzheimer's disease, – Cancer and Rheumatoid Arthritis

69.Margarines diet.2

Margarines are vegetable oils

Light margarine contains less saturated and trans fat than regular margarine. A spread with heart-healthy plant sterols or stanols; 2 grams per day can help lower LDL cholesterol if your diet is low in saturated fat and cholesterol. This light margarine has fewer calories and fat than regular margarine

70.Describe acrolien test.2

On heating with sulfuric acid or KHSO4 (dehydration) it gives acrolein that has a bad odor, used for detection of free glycerol or any compound containing glycerol

In contrast to glycerol Sphingosine does not show positive acrolein test. Therefore glycerolipids and shingolipids can be differentiated on the basis of acrolein test.

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71.Glycerol Trinitrate? (2)

Glycerol combines with three molecules of nitric acid to form Glycerol trinitrate that is used as explosive and vasodilator

72.Discuss glycerol 10 marks

Glycerol and Sphingosine are the two types of alcohols most commonly found in lipids. • Glycerol

It is a simple poly hydroxy alcohol (also called polyol or sugar alcohol) and part of a class of lipids: glycolipids. It contains 3 carbons and 3 hydroxyl (OH) groups. Glycerol is synthesized from Dihydroxyacetone Phosphate (an intermediate of the glycolytic pathway). Dihydroxyacetone phosphate is acted upon by two enzymes to form glycerol, namely Glycerol Phosphate Dehydrogenase and Glycerol Kinase respectively.

Glycerol is a precursor for synthesis of triacylglycerols and of phospholipids in the liver and adipose tissue. When the body uses stored fat as a source of energy, glycerol and fatty acids are released into the bloodstream. And enter the glycolysis pathway directly

ENZYME

73.Enzymes and Classification of Enzyme

A substance produced by a living organism which acts as a catalyst to bring about a specific biochemical reaction.

❖ Oxidoreductases

Catalyze oxidation reduction reactions, further divided into four subgroups, Oxidase, Dehydrogenases, Hydroperoxidases and Oxygenases.

❖ Transferases

These bring about a transfer of functional groups such as phosphate and amino group from one molecule to another molecule called donor and acceptor molecules respectively. The common examples of this group are Transminases, Phosphotransfrases (Kinases). Hexokinase is a phosphotransfease which catalyze the transfer of phosphate groups.

Glucose + ATP → Glucose 6-phosphate + ADP

❖ Hydrolases

These enzymes catalyze hydrolysis, i.e. add water molecule to the substrate which is simultaneously decomposed, the functional group of substrate is transferred to water. Common example of hydrolases are Protein hydrolyzing Enzymes (peptidases), Carbohydrases, and Lipid hydrolyzing enzymes e.g. Lipases

❖ Lyases

Theses enzymes catalyze the addition of NH_3, H_2O or CO_2 to double bonds or the removal of these groups leaving behind double bonds. Lyases are included in a separate class because they catalyze these reactions by means other than hydrolysis or oxidation.

❖ Isomerases

These enzymes catalyze the structural change within a single molecule by the transfer of groups within it, resulting in the formation of an isomeric form of substrate.

❖ Ligases

These enzymes catalyze condensation reactions joining two molecules by forming C-O, C-S, C-N and C-C bonds. The energy for condensation is provided by cleavage of high energy phosphates, e.g. ATP, GTP etc.

74.Enzymes kinetics 2 marks

ASMAT KHAN NIAZI

Enzymes are protein catalysts that, like all catalysts, speed up the rate of a chemical reaction without being used up in the process. They achieve their effect by temporarily binding to the substrate and, in doing so, lowering the activation energy needed to convert it to a product.

75.Define standard energy 2 marks

The standard free energy change ($\Delta G^{o'}$) of a chemical reaction is the amount of energy released in the conversion of reactants to products under standard conditions.

76.Order reaction 5 marks

When [S] is much less, then the velocity of the reaction is approximately proportional to the substrate concentration. The rate of reaction is then said to be first order with respect to substrate. When [S] is much greater than Km the velocity is constant and equal to Vmax. The rate of reaction is then independent of substrate concentration, and is said to be zero order with respect to substrate concentration.

Reaction Orders with Respect to Substrate Concentration

Order	Rate Equation	Comments
Zero	Rate = k	Rate is independent of substrate concentration
First	First rate = k[S]	Rate is proportional to the first power of substrate concentration
Second	Rate = k[S1][S2]	Rate is proportional to the first power of each of two reactants

77.Reaction velocity 3 mark

The rate or velocity of a reaction (v) is the number of substrate molecules converted to product per unit time; Velocity is usually expressed as µmol of product formed per minute. The rate of an enzyme-catalyzed reaction increases with substrate concentration until a maximal velocity (Vmax) is reached- reflecting the saturation with substrate of all available binding sites are occupied on the enzyme molecules present.

$V = k [S_1][S_2]$

78.Enzyme Inhibitor

Enzyme inhibitors are molecular agents that interfere with catalysis, slowing or halting enzymatic reactions. Any substance that can decrease the velocity of an enzyme-catalyzed reaction is called an inhibitor.

79.What are cofactor, coenzyme and prosthetic group

If the non-protein moiety is a metal ion such as Zn2+ or Fe2+, it is called a **cofactor**. There are two types of cofactors: inorganic ions [e.g., zinc or Cu(I) ions] and organic molecules known as coenzymes.

If it is a complex organic molecule or metallo-organic compound it is termed a **coenzyme**. FAD, (Flavin Adenine Dinucleotide), NAD+ (Nicotinamide adenine Dinucleotide) and NADP+ (Nicotinamide adenine Dinucleotide Phosphate)

A coenzyme or metal ion that is very tightly or even covalently bound to the enzyme protein is called a **prosthetic group.**

80.entropy(2)

Entropy is defined as the measurement of degree of randomness or in other words, it is the increase in the disorganization within a system. Entropy is a measure of the randomness or disorder in a system

81.advantages of Lineweaver-Burk plot and equation

Lineweaver-Burk plot, has the great advantage of allowing a more accurate determination of Vmax,

Which can only be approximated from a simple plot of V_0 versus [S]

The double-reciprocal plot of enzyme reaction rates is very useful in distinguishing between certain types of enzymatic reaction mechanisms and in analyzing enzyme inhibition.

Equation

In the Lineweaver-Burk equation, K_m/V_{max} is the slope (or m) and $1/V_{max}$ is the y-intercept

82.Mention some inorganic element that serve cofactor?5

These are:

Cytochrome oxidase, catalase, peroxidase, pyruvate kinase, hexokinase, glucose 6-phosphatase, anginas, ribo-nucleotides reductase

83.Define standard energy 2 marks

The amount of energy released in the conversion of reactants to products under standard conditions.

84.Induced fit Model

The induced-fit model explains the protein conformational changes in the binding process. This model suggests that an enzyme, when binding with its substrate, optimizes the interface through physical interactions to form the final complex structure. In the induced fit model, both the substrate and the active site of the enzyme change in conformation until the substrate is completely bound to the enzyme, at which point the final shape and charge is determined. This activates the enzyme into performing its catalytic function.

85.Induced fit hypothesis and theory

Some proteins can change their shape (conformation)

When a substrate combines with an enzyme, it induces a change in the enzyme's conformation. This change in conformation when the substrate binds is induced by multiple weak interactions with the substrate. There may also be rearrangements of covalent bonds during an enzyme-catalyzed reaction. This conformational change is referred to as induced fit. The Induced Fit Hypothesis

Chemical reactions of many types take place between substrates and enzyme's functional groups (specific amino acid side chains, metal ions, and coenzymes.

Induced fit serves to bring specific functional groups on the enzyme into the proper position to catalyze the reaction.

Induced Fit Theory

Enzyme is not rigid, changes shape with substrate. The active site is also moulded into a precise conformation • Making the chemical environment suitable for the reaction

13.KM by Michaelis small and large Km

The substrate concentration at which V_0 is half maximal is Km, the Michaelis constant. Km reflects the affinity of the enzyme for the substrate.

ASMA AL NIAZI

Small Km: A numerically small (low) Km reflects a high affinity of the enzyme for substrate, because a low concentration of substrate is needed to half-saturate the enzyme—that is, to reach a velocity that is 1⁄2 Vmax

Large Km: A numerically large (high) Km reflects a low affinity of enzyme for substrate because a high concentration of substrate is needed to half-saturate the enzyme

86.Haxokinasis

Hexokinase is a phosphotransfease which catalyze the transfer of phosphate groups.

Glucose + ATP → Glucose 6-phosphate + ADP

Hexokinase catalyses the first step in glucose metabolism in most cells, the transfer of a phosphate from ATP to glucose to form glucose 6-phosphate.

Hexokinase I, the isozyme in red blood cells has a low Km for glucose of approximately 0.05 mM- helpful in utilizing blood glucose even when the blood glucose concentration is very low.

The **isozyme of hexokinase,** called glucokinase, which is found in the liver, has a much higher Km of approximately 5 to 6 mM- helpful in storing large amounts of "excess" glucose as glycogen or converting it to fat after a carbohydrate meal.

87.Isozyme hexokinase illustrate the significance of KM

A comparison between the isozymes of hexokinase illustrates the significance of the Km. Hexokinase catalyses the first step in glucose metabolism in most cells, the transfer of a phosphate from ATP to glucose to form glucose 6-phosphate. Hexokinase I, the isozyme in red blood cells has a low Km for glucose of approximately 0.05 mM- helpful in utilizing blood glucose even when the blood glucose concentration is very low. The isozyme of hexokinase, called glucokinase, which is found in the liver has a much higher Km of approximately 5 to 6 mM- helpful in storing large amounts of "excess" glucose as glycogen or converting it to fat after a carbohydrate meal

88.Describe Ligend.10

In biochemistry and pharmacology, a ligand (from the Latin ligandum, binding) is a substance (usually a small molecule), that forms a complex with a biomolecule to serve a biological purpose. In a narrower sense, it is a signal triggering molecule, binding to a site on a target protein

A molecule bound reversibly by a protein is called a ligand.

Ligands include substrates, inhibitors, activators, and neurotransmitters

A ligand may be any kind of molecule, including another protein.

A ligand binds at a site on the protein called the binding site, binding site is complementary to the ligand in size, shape ,charge, and hydrophobic or hydrophilic character.

Furthermore, the interaction is specific: the protein can discriminate among the thousands of different molecules in its environment and selectively bind only one or a few.

The binding of a protein and ligand is often coupled to a conformational change in the protein that makes the binding site more complementary to the ligand, permitting tighter binding called induced fit.

A given protein may have separate binding sites for several different ligands.

In a multi-subunit protein, a conformational change in one subunit often affects the conformation of other subunits.

Interactions between ligands and proteins may be regulated, through interactions with additional ligands.

These other ligands may cause conformational changes in the protein that affect the binding of the first ligand.

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89.PH

PH is **a measure of how acidic/basic water is**. The range goes from 0 - 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. PH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water

90.Buffer 3 marks

Buffers are aqueous systems that tend to resist changes in pH when small amounts of acid (H+) or base (OH-) are added • A buffer system consists of a weak acid (the proton donor) and its conjugate base (the proton acceptor) • As an example, a mixture of ; acetic acid and acetate ion, is a buffer system. It is important for the process or reaction in which is require for the stable and pH ranges.

Buffer Composition:

To relatively the maintain the pH of the solution a buffer is must consist the acid-base pair meaning

- A weak base and a conjugate acid
- A weak acid and conjugate base

The use of one or more depend upon the desired pH when preparing the buffer

Example: Acetic acid such as sodium acetate (CH3COOH) in which they have conjugate acid. Ammonia (NH3) and a salt (Nacl) in which they have conjugate base.

91.Pka value of lactetic acid determine

Calculate the pKa of lactic acid, given that when the concentration of lactic acid is 0.01M and the concentration of lactate is 0.087 M, the pH is 4.80

PH= pKa + log [lactate]/[lactic acid]

pKa = pH- log [lactate]/[lactic acid]

= 4.80 - log 0.087/0.01

= 4.80 - log 8.7

= 4.80 - 0.94

= 3.9

1. Why Alpha helix de stabilize due to cycstein
2. How activation energy relate to rate of reaction 5marks

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