

2018

SUBJECTIVE TYPE**Q. NO. 2. Attempt any 10 of the following questions. Each question carries two marks. (20 MARKS)****I. How carbohydrates and sugars are used by the body?**

ANS: When you eat carbs, your body breaks them down into simple sugars, which are absorbed into the bloodstream. As the sugar level rises in your body, the pancreas releases a hormone called insulin. Insulin is needed to move sugar from the blood into the cells, where the sugar can be used as an energy source.

II. How Ribosomes are involved in Protein Synthesis?

ANS: The ribosome is universally responsible for synthesizing proteins by **translating the genetic code transcribed in mRNA into an amino acid sequence**. Ribosomes use cellular accessory proteins, soluble transfer RNAs, and metabolic energy to accomplish the initiation, elongation, and termination of peptide synthesis. Therefore Ribosomes are known as Factory of Proteins

III. What are Nucleic acids?

ANS: These are polymers of Nucleotides. Nucleic acids are naturally occurring chemical compounds that serve as the primary information-carrying molecules in cells. They play an especially important role in directing protein synthesis. The two main classes of nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

IV. Define Evolution.

ANS: In biology, evolution is the change in the characteristics of a species over several generations and relies on the process of natural selection. It is the process by which life is changed from simple to its complex form. The theory of evolution is based on the idea that all species[?] are related and gradually change over time.

V. What are the types of Plastids?

ANS: There are different types of plastids with their specialized functions. Among them, a few are mainly classified based on the presence or absence of the Biological pigments and their stages of development.

- **Chloroplasts:** They are the sites for synthesizing food by the process of photosynthesis.
- **Chromoplasts:** Chloroplasts convert into chromoplasts. Chromoplasts have carotenoid pigments that allow different colours that you see in leaves and fruits. The main reason for its different colour is for attracting pollinators.
- **Gerontoplasts:** These are basically chloroplasts that go with the ageing process. Gerontoplasts refer to the chloroplasts of the leaves that help to convert into different other organelles when the leaf is no longer using photosynthesis usually in an autumn month.
- **Leucoplasts:** These are the non-pigmented organelles which are colourless. They act as a storage sheds for starches, lipids, and proteins depending on the need of the plants. Leucoplasts are of three types:
 - **Amyloplasts** – Amyloplasts are greatest among all three and they store and synthesize starch.
 - **Proteinoplasts** – Proteinoplasts help in storing the proteins that a plant needs and can be typically found in seeds.
 - **Elaioplasts** -Elaioplast helps in storing fats and oils that are needed by the plant.

VI. Differentiate between Nucleus and Nucleolus.

Nucleus	Nucleolus
Large in size	Very small in size
Bound by the nuclear envelope	It has no limiting membrane
It contains chromosomes.	It does not hold any chromosomes
It is rich in DNA, the genetic material	It is rich in RNA

VII. Describe the role of pachytene in meiosis.

ANS: Pachytene encompasses pairing of chromosomes and recombination and repair of DNA, suggesting that p53 controls some aspects of the meiotic cycle to permit DNA shuffling and repair.

➤ The pachytene checkpoint prevents meiotic nuclear division in cells that fail to complete meiotic recombination and chromosome synapsis. This control mechanism prevents chromosome missegregation that would lead to the production of aneuploid gametes.

VIII. What is the chemical composition of cell membrane?

ANS: The components of the plasma membrane

Component	Location
Phospholipids	Main fabric of the membrane
Cholesterol	Tucked between the hydrophobic tails of the membrane phospholipids
Integral proteins	Embedded in the phospholipid bilayer; may or may not extend through both layers

➤ In addition it also contains little amount of carbohydrates in the form of Glycolipids and Glycoproteins

IX. What is inversion mutation?

ANS: Inversions are a special type of mutation in which a piece of chromosomal DNA is flipped 180 degrees. For an inversion to occur, two breaks occur in a chromosome, the region between the breaks gets inverted, and the ends of the region get rejoined to the rest of the chromosome.

X. Differentiate between Alleles and gene.

ANS: A gene is a portion of DNA that determines a certain trait. An allele is a specific form of a gene. Genes are responsible for the expression of traits. Alleles are responsible for the variations in which a given trait can be expressed.

XI. What is the Mendel's law of Independent Assortment?

ANS: See past paper 2016

XII. What is genetic code?

ANS: The genetic code is a set of three-letter combinations of nucleotides called codons, each of which corresponds to a specific amino acid or stop signal. The concept of codons was first described by Francis Crick and his colleagues in 1961.

XIII. What is back cross?

ANS: See past papers 2013 and 2014

XIV. Define segregation

ANS: The Principle of Segregation describes how pairs of gene variants are separated into reproductive cells. The segregation of gene variants, called alleles, and their corresponding traits was first observed by Gregor Mendel in 1865. Mendel was studying genetics by performing mating crosses in pea plants.

The law of segregation states that each individual that is a diploid has a pair of alleles (copy) for a particular trait. Each parent passes an allele at random to their offspring resulting in a diploid organism. The allele that contains the dominant trait determines the phenotype of the offspring.

XV. What is a stop codon?

ANS: A stop codon is a sequence of three nucleotides (a trinucleotide) in DNA or messenger RNA (mRNA) that signals a halt to protein synthesis in the cell.

There are 3 STOP codons in the genetic code - UAG, UAA, and UGA. These codons signal the end of the polypeptide chain during translation. These codons are also known as nonsense codons or termination codons as they do not code for an amino acid.

ATTEMPT ANY TWO OF THE FOLLOWING THREE QUESTIONS.

1. a) How vacuoles play an important role in plants cell. (07)
b) What is sex linked inheritance? Explain with examples (08)
2. a) What are Glyoxisomes and Peroxisomes and discuss their functions. (08)
b) Discuss gene expression regulation (*The Lac operon*) (07)
3. Discuss the basic genetic Engineering techniques and its role in revolutionizing modern life(15)

2019

SUBJECTIVE TYPE

Q. NO. 2. Attempt any 10 of the following questions. Each question carries two marks. (20 MARKS)**I. Define Cell Theory.**

ANS: In biology, cell theory is a scientific theory first formulated in the mid-nineteenth century, that living organisms are made up of cells, that they are the basic structural/organizational unit of all organisms, and that all cells come from pre-existing cells.

II. What is the difference between simple and facilitated diffusion.

Simple Diffusion: Simple diffusion is an unassisted type of diffusion in which a particle moves from higher to a lower concentration.

Facilitated Diffusion: Facilitated diffusion is the transport of substances across a biological membrane through a concentration gradient by means of a carrier molecule.

III. What are Leucoplasts? Mention their functions

Leucoplasts: These are the non-pigmented organelles which are colourless. They act as a storage sheds for starches, lipids, and proteins depending on the need of the plants. Leucoplasts are of three types:

- **Amyloplasts** – Amyloplasts are greatest among all three and they store and synthesize starch.

- **Proteinoplasts** – Proteinoplasts help in storing the proteins that a plant needs and can be typically found in seeds.
- **Elaioplasts** -Elaioplast helps in storing fats and oils that are needed by the plant.

IV. Differentiate between Prokaryotic and Eukaryotic ribosomes.

ANS: Prokaryotic ribosomes are bacterial ribosomes that are small (70S) while eukaryotic ribosomes are large ribosomes (80S). Prokaryotic ribosomes occur free in the cytoplasm while most eukaryotic ribosomes are membrane-bound. Both types of ribosomes consist of two subunits called large and the small subunit.

V. What are Peroxisomes? What is their function

ANS: Peroxisomes are organelles that sequester diverse oxidative reactions and play important roles in metabolism, in synthesis and breakdown of Hydrogen Peroxide (H_2O_2) reactive oxygen species detoxification, and signaling. Oxidative pathways housed in peroxisomes include fatty acid β -oxidation, which contributes to embryogenesis, seedling growth, and stomatal opening.

VI. What are the different types of RNA and their functions.

ANS: See past paper 2016.

VII. What is Transduction?

ANS: Transduction is the process by which a virus transfers genetic material from one bacterium to another. Viruses called bacteriophages are able to infect bacterial cells and use them as hosts to make more viruses.

VIII. What are cytoplasmic inclusions?

ANS: The term cytoplasmic inclusions is used to describe foreign substances contained within a cell membrane. It pertains to nutrients, such as proteins, carbohydrates, and lipids, as well as pigment granules.

IX. Differentiate between population and community.

ANS: The main difference between population and community is that a population is a group of individuals of a particular species living in a particular ecosystem at a particular time whereas a community is a collection of populations living in a particular ecosystem interacting each other at a particular time.

X. What is Synapsis?

ANS: Synapsis is the pairing of two chromosomes that occurs during meiosis. It allows matching-up of homologous pairs prior to their segregation, and possible chromosomal crossover between them. Synapsis takes place during prophase I of meiosis.

ANSWER THE LONG QUESTIONS.

- | | | |
|----|--|------|
| 1. | a) What is the chemical composition of cell membrane? | (07) |
| | b) Describe the ultra structure and function of Chloroplast. | (08) |
| 2. | a) Write a short note on Lac Operon. | (06) |
| | b) Explain the Transduction in Bacteria in detail | (09) |
| 3. | a) Differentiate between Test cross and Back cross and their importance. | (07) |
| | b) Explain with examples Duplication and Deletion. | (08) |

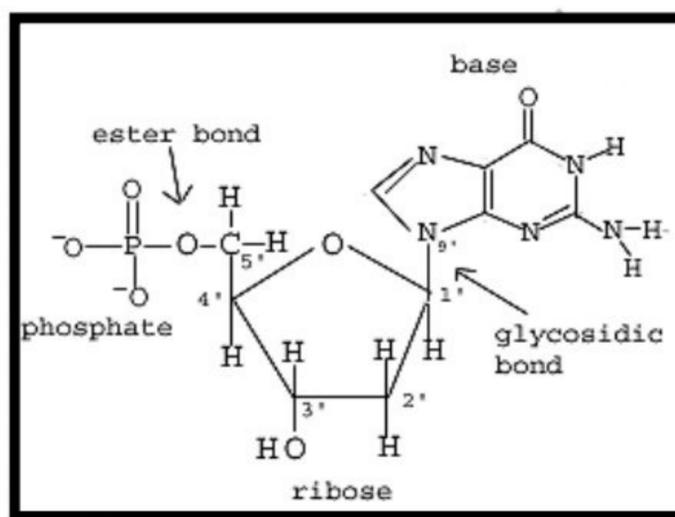
2020

SUBJECTIVE TYPE**Q. NO. 2. Answer the following questions briefly. (20 MARKS)****1. Describe the Physio-chemical nature of the plasma membrane****ANS: CHEMICAL NATURE:**

The principal components of the **Plasma membrane** are **Proteins (60-80 %)**, **Lipids (Phospholipids-20-40 % and Cholesterol)**, and **Carbohydrate groups** that are attached to some of the lipids and proteins (**Glycolipids and Glycoproteins**).

PHYSIOLOGY :

- The plasma membrane surrounds the cell. It encloses itself protoplasm inside.
- It provides mechanical support to the cell.
- All types of transports into and out of cell take place through plasma membrane.
- It is selectively permeable this it allows selective substances to pass through.
- Osmosis, diffusion, active transport and other movements occurs through it.
- Large molecules pass through it by exocytosis and endocytosis.

2. Draw a structure of a nucleotide.**3. What is Transformation?**

In molecular biology, **transformation** is the genetic alteration of a cell by the direct uptake and expression of DNA from its surroundings. **Transformation** occurs naturally in some species of bacteria, and can also be done artificially.

It was first time studied by Fredrick Griffith while he was working on Pneumococcus bacteria.

4. Write a note on Starch.

Starch or amylum is a polymeric carbohydrate consisting of numerous glucose units joined by glycosidic bonds called polymers. This polysaccharide is produced by most green plants as energy storage.

It is a carbohydrate that is the chief form of stored energy in plants, especially wheat, corn, rice, and potatoes. **Starch** is a mixture of two different polysaccharides built out of glucose units, and forms a white, tasteless powder when purified.

Starch is the storage form of glucose in plants. There are **two forms of starch**: Amylose and Amylopectin. Structurally they differ in that amylose is a linear polysaccharide so soluble in hot water whereas amylopectin is branched and insoluble in both cold and hot water.

5. How conjugation is involved in Bacterial DNA recombination?

Bacterial conjugation is the transfer of genetic material between bacterial cells by direct cell-to-cell contact or by a bridge-like connection between two cells. This takes place through a pilus. It is a parasexual mode of reproduction in bacteria.

During conjugation, one bacterium serves as the donor of the genetic material, and the other serves as the recipient.

In conjugation, DNA is transferred between bacteria through a tube between cells. Transposable elements are chunks of DNA that "jump" from one place to another. They can move bacterial genes that give bacteria antibiotic resistance or make them disease-causing.

6. What are Base Analogues?

Base analogues are molecules that can substitute for normal bases in nucleic acids. Usually, substitution of a base analogue will result in altered base pairings and structural changes that affect DNA replication and transcription of genes.

Base Analogues

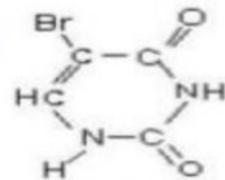
nucleoside analog: molecules which are structurally similar to normal nitrogenous bases but have slightly altered base-pairing properties

Normal nitrogenous base

Adenine

Thymine

5-Bromouracil



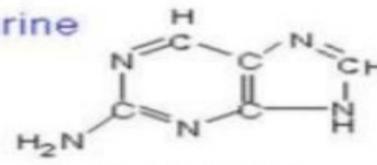
pair up with
adenine and cytosine

Analog

2-Aminopurine

5-Bromouracil

2-Aminopurine



pair up with
thymine and guanine

induce nonsense or missense mutation

7. Differentiate between Plasmid and Episome.

Episome VS Plasmid

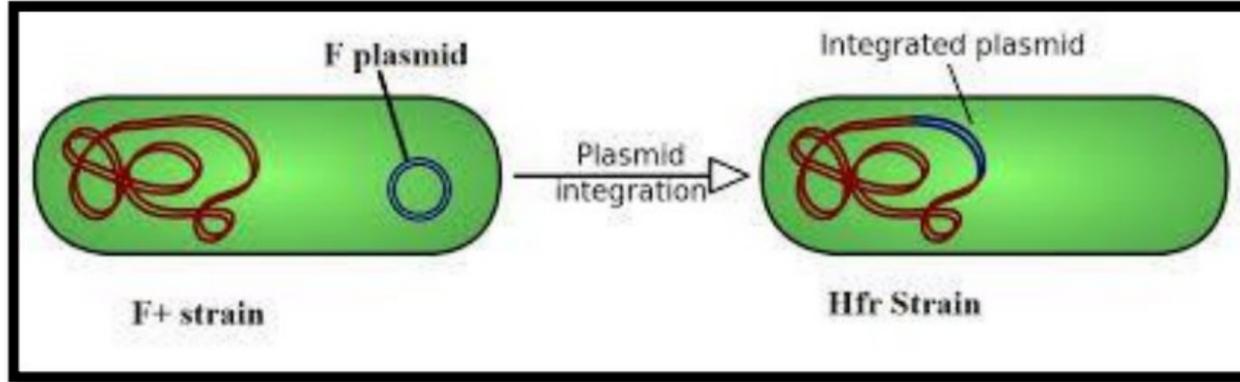
- Plasmid DNA is an extra-chromosomal DNA molecule, it cannot link up with chromosomal DNA, and it contains the genetic informations that are necessary for its own replication.
- Episomes is any kind of extra-chromosomal DNA that can link up with chromosomal DNA. That is the main difference between them two.
- Episomes are usually larger than other extra-chromosomal DNA. An example of episome are the viruses, because they intergrate their genetic material into the host's chromosomal DNA.

- Also, **plasmids** mainly occur in prokaryotes while in eukaryotes, **episomes** behave as **plasmids** in prokaryotes.

8. What are Hfr Strain?

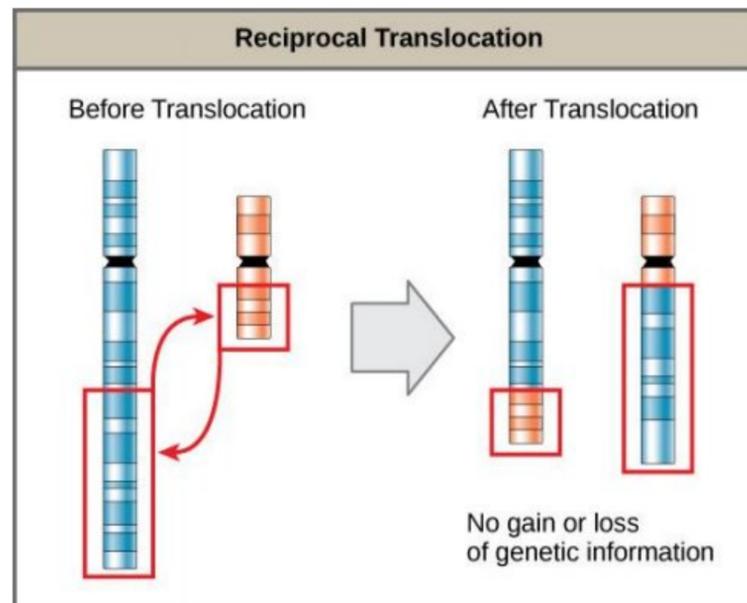
ANS: A high-frequency recombination cell (**Hfr** cell) (also called an **Hfr strain**) is a bacterium with a conjugative plasmid (for example, the F-factor) integrated into its chromosomal DNA. The integration of the plasmid into the cell's chromosome is through homologous recombination.

When conjugation occurs, Hfr cells are very efficient in delivering chromosomal genes of the cell into recipient F⁻ cells, which lack the episome.



9. What is Reciprocal Translocation?

ANS: Reciprocal translocations occur due to the exchange of chromosome material between two nonhomologous chromosomes. When the amount of genetic material is balanced, there is no phenotypic effect on the individual because of a balanced complement of genes.



10. How the phenomenon of tautomerism cause mutation

ANS: Mutations can occur spontaneously; one such cause is tautomerization.

The tautomer form of the base hydrogen-bonds to an incorrect base, and so the base laid down during replication will be wrong, inducing a mutation (if this mismatch is preserved through another round of replication)

Likewise, cytosine and adenine are normally in amino forms, but when in the rare imino forms they can join by two hydrogen bonds with amino forms of adenine or cytosine, respectively. Tautomeric shifts that modify the pairing of nucleotides can result in base substitutions and, as a result, mutations.

Answer the Long Questions.

(3x10=30)

- Q.3.** (a) What is the role of Histone in DNA packaging? (05)
 (b) Describe Mendel's Law of inheritance. (05)
- Q.4.** (a) Describe the types of chromosomes on the basis of the position of centromere (05)
 (b) How generalized transduction is different from specialized transduction? (05)
- Q.5.** (a) What are mutagens? How radiations can cause mutation? (05)
 (b) Differentiate between Induced and Spontaneous Mutations? (05)

2021

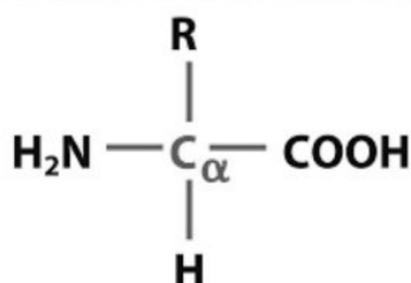
SUBJECTIVE TYPE**Q. NO. 2. Answer the following short questions. (10x2=20)**

- i. **What is meant by the term “Fluid Mosaic” as Model of Plasma Membrane structure?**

ANS: The fluid mosaic model describes the cell membrane as a tapestry of several types of molecules (phospholipids, cholesterol, and proteins) that are constantly moving. This movement helps the cell membrane maintain its role as a barrier between the inside and outside of the cell environments.

According to this model, proteins are not confined and continuous but embedded in lipid bilayer in a mosaic manner just like ice berg in Lipid Sea.

- ii. **Draw generalized structure of amino acid.**

General Structure of α -Amino Acid

- iii. **What is Transduction?**

ANS: See past paper 2019

- iv. **Name two component types of starch.**

➤ **ANS:** Starches are of two types, amylose and amylopectin.

Amylose	Amylopectin
Amylose starches have unbranched chains of glucose and are soluble in hot water	Amylopectin starches have branched chains and are insoluble in hot or cold water.

- v. **How conjugation is involved in bacterial DNA recombination?**

ANS: Transfer of genetic material occurs during the process of bacterial conjugation. During this process, DNA plasmid is transferred from one bacterium (the donor) of a mating pair into another (the recipient) via a pilus.

- vi. **What are base analogue?**

ANS: See past paper 2020

- vii. **Define mutation.**

ANS: A mutation is a sudden change in genetic material that occurs in our DNA sequence, either due to mistakes when the DNA is copied or as the result of environmental factors such as UV light and cigarette smoke.

➤ It also refers to the change in number or structure of chromosomes called mega mutations.

- viii. **What is the function of DNA polymerase?**

ANS: The primary role of DNA polymerases is to accurately and efficiently replicate the genome in order to ensure the maintenance of the genetic information and its faithful transmission through generations.

➤ DNA polymerase is responsible for the process of DNA replication, during which a double-stranded DNA molecule is copied into two identical DNA molecules. Scientists have taken

advantage of the power of DNA polymerase molecules to copy DNA molecules in test tubes via polymerase chain reaction, also known as PCR.

ix. What do you understand by "Inheritance of Acquired Characters"?

ANS: The inheritance of acquired characters (or characteristics) is the hereditary mechanism by which changes in physiology acquired over the life of an organism (such as muscle enlarged through use) are purportedly transmitted to offspring.

- The theory of the inheritance of acquired characteristics, or "soft inheritance," holds that an organism experiencing such a modification can transmit such a character to its offspring. This theory is commonly equated with the evolutionary theory of French naturalist Jean-Baptiste Lamarck known as Lamarckism.

x. Define chromosomal aberration.

ANS: Chromosome aberrations include changes in chromosome number (gains and losses) and changes in structure (deletions, inversions, and exchanges). Chromosomes can be viewed by standard light microscopy and many of these aberration types can be observed.

ANSWER THE LONG QUESTIONS.

1. Describe law of segregation with the help of a cross. (10)
2. Describe the types of chromosomes on the basis of position of centromere. (05)
3. Write a note on Transduction as method of bacterial recombination. (05)
4. a) What are mutagens? How radiation can cause mutation? (03)
b) Differentiate between Induced and Spontaneous mutation. (02)
5. a) What is euploidy? Explain with an example. (02)
b) Differentiate between Inversion and Translocation. (03)

2022

SUBJECTIVE TYPE

Q. NO. 2. Answer the following short questions. (10x3=30)

i. Define conjugation.

ANS: Conjugation is the process by which one bacterium transfers genetic material to another through direct contact. During conjugation, one bacterium serves as the donor of the genetic material, and the other serves as the recipient. The donor bacterium carries a DNA sequence called the fertility factor, or F-factor

ii. What is difference between generalized and specialized transduction?

ANS: There are two types of transduction: generalized and specialized. In generalized transduction, the bacteriophages can pick up any portion of the host's genome. In contrast, with specialized transduction, the bacteriophages pick up only specific portions of the host's DNA.

iii. What is basic principle of genetic engineering?

ANS: The principle of genetic engineering is to manipulate and modify the genetic material of an organism to incorporate desirable traits. Recombinant DNA technology is the main pillar of genetic engineering. Recombinant DNA Technology is a technique to alter the genes of an organism.

iv. What is the difference between same sense mutation and non sense mutation?

Same sense mutation	Non sense mutation
A same-sense mutation is form of silent mutation where a change in the base sequence of a gene does not result in a change in the amino acid	Nonsense mutation is a point mutation which introduces a premature stop codon into mRNA sequence as a result of a nucleotide change. It is a

sequence of the protein for which the gene carries the genetic instructions.

change in DNA that causes a protein to terminate or end its translation earlier than expected.

v. **Define evolution. What are its types?**

ANS: Evolution is a process that results in changes in the genetic content of a population over time. There are two general classes of evolutionary change: microevolution and macroevolution.

➤ When populations change in small ways over time, the process is called microevolution. Microevolution results in changes within a species. Macroevolution refers to much bigger evolutionary changes that result in new Species.

vi. **What is difference between starch and cellulose?**

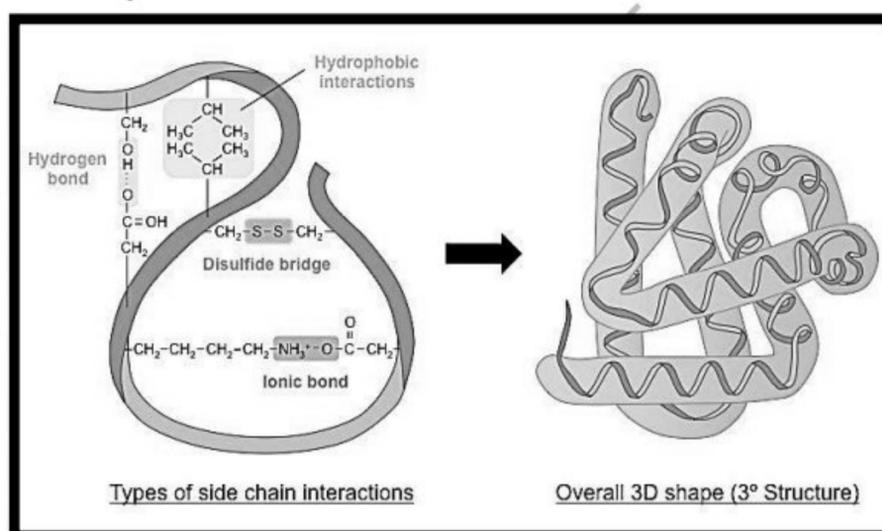
ANS: Both starches and cellulose are made of glucose molecules, but the difference between them is that starch is a branched polymer, while cellulose is a linear polymer.

➤ **Starch** is made up of alpha glucose while **cellulose** is made up of beta glucose.

vii. **Differentiate between saturated and unsaturated fats.**

ANS: Saturated fats (including a type called trans fat) tend to stay solid and can cause fatty deposits in blood vessels, leading to atherosclerosis ("hardening of the arteries"). By contrast, unsaturated fats stay liquid at room temperature and are less likely to clog your arteries.

viii. **Draw tertiary structure of proteins?**



ix. **What is difference between glyoxisomes and peroxisomes?**

ANS: **Peroxisomes** are microbodies that are known to contain catalase and at least one flavin oxidase like peroxidase involved in the synthesis as well as breakdown of hydrogen peroxide, while **glyoxisomes** are microbodies that contain, in addition, isocitrate lyase and/or malate synthetase, two enzymes of the glyoxylate cycle.

x. **What are purines? Give its types**

ANS: Purine is a heterocyclic aromatic organic compound that consists of two rings (pyrimidine and imidazole) fused together. It is **water-soluble**.

➤ There are two main types of purine: Adenine and Guanine. Both of these occur in both DNA and RNA.

ANSWER THE LONG QUESTIONS.

3x10=30

1. a) Explain Lac Operon
b) What is genetic recombination and its types.
2. a) Define crossing over. Explain its mechanism
b) What is inversion and translocation?
3. a) What are different types of Endoplasmic Reticulum? Explain their functions.
b) Explain the functions of Plasma Membrane.