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BIOLOGY

Class 9th (KPK)

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Chapter # 01

Introduction to Biology

Q1: Define Biology. Describe various branches of biology.

Ans: **Word "Biology"**

In 1736 Swedish scientist Carl Linnaeus for the first time used the world biology.

Meaning:

The word biology has been derived from two Greek words.

- **"Bios"** meaning life or living things.
- **"logos"** meaning to study, knowledge or thoughts.

Definition:

Biology is the natural science which deals with the study of living organisms **Main branches of Biology:**

There are three main branches of Biology

- **Botany:** The study of plants.
- **Zoology:** The study of animals
- **Microbiology:** The study of microorganisms such as viruses and Bacteria etc.

Other branches of Biology:

i. **Morphology (Morph: Form):** The branch of biology which deals with the study of form and structure of living organisms.

ii. **Anatomy (Ana – up – tomia - cutting):**

The branch of biology which deals with the study of internal structure of living organisms is called anatomy.

iii. **Histology:**

The Microscopic study of animal and plants tissues is called histology.

iv. **Physiology (Physic-function):**

The branch of biology which deals with the study of the function of different parts of living organisms is called physiology.

v. **Embryology**

The branch of biology which deals with the study of development of a new individual from a fertilized egg (zygote) is called embryology.

vi. **Taxonomy (Taxa – arrangement + namia - distribution)**:

The branch of biology which deal with the study of naming and classification of organisms into group and sub-groups on the basis of similarities and difference among them is called taxonomy

vii. Cell biology/cytology:

The study of the structure and function of cell, cell organelles and division is called cell biology or cytology.

viii. Palaeontology (Paleous – ancient, anta- beings):

The study of fossils of the extinct organisms is called palaeontology.

Sub Branches of Palaeontology:

There are two sub branches of palaeontology

a) Palaeobotany

b) Paleozoology **ix. Immunology:**

The branches of biology which deals with the study of immune system of animals and plants is called immunology. **Immune system:**

The defines system of living organisms which fight against disease causing microbes is called immune system.

x. Entomology(entomon-insect):

The branch of biology which deals with the scientific study of insects called entomology. **xi. Genetics:**

The branch of biology which deals with the study of heredity character transmitted through genes from parents' offspring is called genetic **xii. Microbiology:**

The scientific study of microorganisms is called microbiology **Microorganism:**

Those organisms which cannot be seen through naked eyes and can studied only under microscope are called microorganisms e.g. bacteria viruses etc.

xiii. Biotechnology:

The branch of biology which deals with the study of practical application of living organisms for the welfare of human being.

Example:

Use of yeast, synthesis of drugs & antibiotics, preservation of food and cloning.

xiv. Environmental Biology/Ecology (eikos - house):

The branch of biology deals with the study of inter-relationship between the organisms and their environment is called ecology.ie Relation between biotic and abiotic components of ecosystem.

xv. Parasitology: -

The branch of biology deals with the study of parasites.

Parasites:

Those organisms which take food and shelter from living hosts and harm them are called parasites e.g. mosquito, bacteria etc.

xvi. Social biology:

The branch of biology deals with the study of social behaviour of some animals such as bees, Ants, Flocking birds etc. **xvii. Pharmacology:**

The branch of biology deals with the scientific study of drugs, their formation and effects on the system of human body.

Q2: Briefly establish the linkage between biology with physics chemistry, Geography, Statistic and Economics

Ans: - Biology is not an isolated subject but it is a multidisciplinary science which means that it has great relationship with other fields of study. Some of the emerging fields are as follows.

i. Biophysics: - Definition:

The study of biological processes using the principles of physics is called Biophysics.

Development

The understanding of physics for a biologist helps in using the principles and techniques of physics in biological phenomena. Biophysics developed after world war II.

Example:

- There is a similarity between the working principles of lever in physics and limbs of animal in biology.
- Use of x- ray, MRI, CT scan for diagnosis purpose.
- Used in physiology, bioenergetics, neurosciences and pharmacology etc. **ii. Biochemistry:**

Definition:

It is concerned with chemical substance and processes that occur in living organism is called Biochemistry **Example:**

- Photosynthesis, Respiration etc.
- Biochemistry is also related with the study of molecular components such as carbohydrates, Protein, Fats etc.

iii. Biogeography: - Definition:

The study of distribution of various living organisms in different geographical region of the world is called Biogeography **Explanation:**

Scientist study of animal distribution to understand the spread of animals borne diseases. it is Concerned with the study of distribution of plants and animals' preservation of rare species and changing geography.

Example:

In biogeography we study why polar bears are found only in certain part of the arctic region.

iv. Bio-statistics or Biometry or Biomathematics:

Definition:

It deals with the study of biological processes using statistical and mathematical formulas and techniques.

After experimental work biologist apply the rule of statics or mathematics to design, analyze and interpret of research data.

Example:

- Used in various research field.
- Used for agricultural and medical application

v. Bio- economics:

Definition:

The study of organisms with economics point of view is called bio-economics. Both plants and animals play a vital role in the economy of the country. In bio-economics scientist Calculate and compare the cost and profit of the biological project. Plants as well as diseases directly and indirectly affect the economic sphere of humanity.

Example:

Production of new varieties of crops.

Q 3: Describe different careers plants in the field of Biology.

Ans: Biological science is related to a wide range of professions. Some of these career paths are,

Field of medicine and surgery:

- The profession of medicine is related with the diagnosis and treatment of human diseases.
- In surgery the part of the body may be removed, repaired or replaced i-e the removal of stones through renal surgery Transplantation of kidney, heart and liver etc
- After studying biology in higher secondary level, a student can choose to become a medical doctor (MBBS)\ **Fisheries:**
- This profession is related to the production of fish.
- In this field biologist study the various aspects of fish such as habitat, requirement population, life cycle, disease and effect of pollutant
- Fisheries manager serves for enhancing the quality and quantity of fish production
- One can adopt this career after completing a bachelor or master degree in zoology

Agriculture:

- The science of farming includes the growing of crops and rearing of animals is called agriculture
- Agriculturalist study the crop like wheat, rice corn etc and livestock like buffalo, cow
- In Pakistan there are many Agricultural Universities which offer professional courses in agricultural department, veterinary and pharmaceutical industries, food industries, farming and agricultural banks etc

Animal Husbandry:

- It is also called Animal science
- It is concerned with the care and breeding of domestic animals (lice stock) e.g. cattle, sheep etc
- Student of animals, science can get degree in veterinary science after the higher secondary education in biology.
- Graduate in animals science work in veterinary and pharmaceutical industries, livestock and farming etc.

Horticulture:

- It is the professional study of gardening.
- It is a skill to work for the betterment of commercial nurseries, ornamental plants in parks and work for the creation of green belt ornamental plants in parks and work for the creation of green belt along the high ways, parks, residential areas etc.
- Horticulturist can open business and find jobs in fruits and vegetables production, landscape design, nurseries, gardens and pest management etc. **Forestry:**

Forestry is the art and science of managing forests it concerned.

- Growing forests to provide timber.
- For developments of natural resources.
- For protection of wildlife habitat.
- For recreation

Many universities offer professional courses in forestry after the higher secondary education in biology.

Farming:

- In farming farms are developed and maintained for animal breeding, poultry, fruit and vegetables.
- A student can adopt this field after getting professional training agriculture and animals husbandry.

Forensic science:

- The use of scientific methods in the investigation of crimes is known as forensic science.
- Forensic biologists work with police department and other process evidence that can be used to detect crimes. **Example:** DNA Fingerprinting **Health care:**

Biologist work to prevent many health problems such as tuberculosis, cancers and heart diseases

Q.4: Discuss five kingdom system of classification.

Ans: According to five kingdom system of classification as organisms are classified into five kingdoms. In 1969 Robert Whittaker introduced this system. These five kingdoms are,

i. Kingdom Monera (Prokaryotes):

Characteristics:

- They contain prokaryotic organisms.
- All these organisms are unicellular and microscopic.

- Nuclear membrane and membrane bounded organelles are also absent.
- Their cell wall is made up of murine (Sugar + amino acid also called peptidoglycan) ➢ They are simplest in all living organisms.

Examples:

Bacteria, blue green Algae (cyanobacteria).

ii. Kingdom Protista (Gr-Protista _ very first) Characteristics:

- It includes eukaryotic unicellular and simple multicellular organisms.
- Usually live in aquatic habitat.
- Some contain chlorophyll and prepare their own food while some lack chlorophyll and cannot prepare their own food.
- Some organisms are plant like, some are animal like and some are fungus like

Examples:

Plant like	Chlamydomonas
Fungus like	slime molds
Animal like	Amoeba etc

iii. Kingdom Fungi:

Characteristics:

- They are eukaryotic multicellular organisms.
- They are heterotrophs because they cannot synthesize their own food.
- The food is stored inside the body in the form of glycogen.
- Their cell wall is made up of chitin.
- They take their food by absorption (saprophyte) **Example:**

Bread mold, mushroom, puffballs and yeast etc. **iv.**

Kingdom Animalia:

Characteristics:

- They include eukaryotic multicellular animals.
- Centrioles are present in the cells.
- They have no chlorophyll and cannot prepare their own food.
- This kingdom contains both vertebrate and invertebrate animals.

Example:

Vertebrates: They have back bone e.g. fish, birds and mammals etc.

Invertebrates: They have no back bone e.g. insect, Ant, Jellyfish, worm etc.

v. Kingdom plantae:

Characteristics:

- They include eukaryotic multicellular plants.
- They are autotrophic and can prepare their own food in the process of photosynthesis.
- Their cell was is made of cellulose.
- Centrioles are present in the cells.
- Mostly lack of centrioles inside their cells.
- They reserve food in the form of starch.

Example:

Wheat, Pinus, Mango, Mulberry, Ferns etc.

Q.5: Discuss Biology in the light of Holy Quran.

Ans: According to the Quranic teachings Allah, is the ultimate creator of every living and nonliving things. Some of the Quranic verses in this regard are quoted below **Translations:**

"Allah created man from sounding clay like the clay of pottery"

"Then we made the sperm into a clot of congealed blood. Then of that clot We made a (fetus) lump. We made out of that lamp bones and clothed the bones with flesh then we developed out of it another creature so blessed Allah, the best to create"

"We made from water every living thing. Will l they not then believe?"

"And in the earth are the tracts (diverse though) neighbouring, gardens of vines and field sown some with corn and palm trees-growing out of single roots or otherwise. Watered with the same water. Yet some of them we make more excellent than other to eat"

"And Allah created every animal from water. Some creep up on their bellies other walks on two legs and others on four. Allah creates what he pleases (wills) he has power over all things"

Q.6: Describe the contribution of Muslims scientist in the field of Biology. Ans:

Contribution of Muslim scientist:

i. Jabir Bin Hayyan

Name: He is also known in Europe by the name Geber.

Date of Birth: He was born in 721 A.D in Iran and practiced medicine in Iraq.

Father of chemistry: He is also known as father of chemistry.

Contribution: His most important contribution is in the field of chemistry especially practical application of chemistry like discovery of sulphuric acid and vinegar. He was also an astronomer, pharmacist physician, philosopher and engineer.

Books: He wrote a number of books are.

Al-Nabatat: In this book he discussed various aspects of plants life and forms.

Al-Hayawan: In this book he has described variety of animals, their structure and habitat.

Date of death: Jabir was died in 815 A.D **ii.**

-Abdul Malik Aasmai:

Date of birth: He was born in 740 A.D in Busra

Contribution: He contributed for advancement in zoology, botany and animal husbandry.

Animal Sciences: Abdul Malik Aasmai was regarded as the specialist of animal sciences.

Famous books: His famous books are as follows.

- **Al-lbil :** The book was written on the camels.
- **Al-kheil:** The book about horses.
- **Al-wahoosh:** The book about wild animals
- **Al –sha:** The book about sheep
- **Khalaq-ul-Insan:** The book about human being

Date of Death: He died in 828 A.D **iii.**

Bu Ali sina:

Other Name: He is also called Avicenna in west.

Date of birth: He was born in Bukhara, city of Iraq in 980 AD.

Contribution: Hisvaluable contribution was in the field of medicine. He is also known as father of medicines. He was an expert in mathematics, astronomy, physics and palaeontology. He discovered 760 various type of drugs.

Famous Book:

His famous book “AL-Qanoon-fil-tibb” as known as canon of medicine in west He described 130 disease of eye in his book.

Date of death: He died in 1037 A.D **iv.**

Abu Usman Umar Al-jahiz:

Date of Birth: He was born in Basra, city of Iraq in 766 A.D

Contribution: He was a well-known zoologist. He described the life system of ants and his own observation on seasonal migration of fishes in Tigris River.

Book: He famous books was Al Haywan. In this book he described the characteristics of 350 species of animals especially about life of ants. **v. Al-Farabi: (870-950AD):**

Date of Birth: He was born in 870 A.D

Contribution: He has a contribution in the field of Hikmat and biology and he was the renowned Hakim and biologist of the Islamic world. **Books:** He wrote two well – known books, ➢ Kitab – ul –Nabatat about plants.

➢ Kitab – Ul – Haywanat about animals.

Date of death: He died in 950 A.D **vi. Abdul Qasim Ali Zahravi (936 AD – 1004AD) Date of Birth:** He was born in 936 A.D.

Contribution: He was regarded as the renowned surgeon of Islamic world. He was famous for the removal of stone from urinary bladder. He was expert in the making of various types of dissecting equipment.

Date of death: He died in 1004 A.D **vii.**

Ibn – Ul – Haitham(965-1039 AD):

Date of Birth: He was born in 965 A.D.

Contribution: He was a great optician. He corrected the Greek conception of vision. He located retina as a site of vision.

Books:

- Kitab – ul – Manazir about eye
- Mizan – ul – Hikma deals with medicines.

Date of Death: He died in 1039 A.D **viii.**

Ali Bin Isa:

Date of Birth: 940 A.D

Contribution: He was a well – known eye specialist (ophthalmologist). He worked on the structure, function and diseases of eyes. He described 130 disease of eye in his books.

Date of Death: 1010 A.D.

ix. Ibn – AL – Nafees:
Dare of birth: 1210 A.D.
Contribution: He was a renowned biologist of 13th century A.D. He described the circulation of blood in human body. **Date of Death:** 1288 A.D.

Q.7: Describe various level of biological organization.

Ans: Levels of Biological Organization:

In order to understand the various phenomena of life, biologist study biological organization at different level.

i. Atomic and Sun-atomic level:

All type of matter is made up of elements and each element contain a single kind of atoms.

Atom (a-not,tom-cut):

The smallest particle of matter is called Atom. Atoms are made of many sub atomic particles.

Sub atomic particles:

Atom is composed of sub atomic particles such as proton, electron and neutrons.

. Proton: It has positive charge and present in the nucleus.

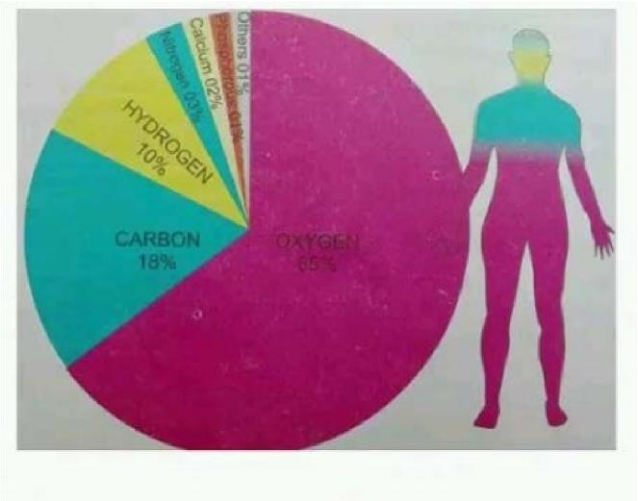
. Electron: It has negative charge and present in shells around the nucleus. **.**

Neutron: It has no charge (neutral) and present in the nucleus.

Bio elements:

Out of 92 natural occurring elements, 16 elements are called bio elements. These take part in making the body mass of a living organisms in these 16 bio elements Only O, C,H, Ca, and P make 99% of the total mass of protoplasm while other ten bio elements potassium, Sulphur , chlorine, sodium, magnesium, iron copper, manganese, zinc and iodine make 1 % of the total mass of the protoplasm.

a) Oxygen = 65%
b) Carbon = 18%
c) Hydrogen = 10%
d) Nitrogen = 03%
e) Calcium =02%
f) Phosphorous=01%
g) Other elements=01%



ii. Molecule level:

Definition:

A group of atoms bonded together is called molecule e.g. H_2, N_2, O_2etc

i. Biomolecule:

Definition:

In Organisms bio elements do not occur in isolated from they combine through ionic or covalent bonding. The stable particle formed by such bonding is also called Bio molecule.

Type of Biomolecules:

a. Micro molecules:

The molecules which have low molecular weight are called micro molecules.

Example:

Glucose, water amino acid etc

b. Macro molecules:

The molecules which have higher molecular weight **Example:**

Carbohydrates, protein and lipid etc **ii.**

Compounds:

Definition:

The chemical combination of two or more than two elements is called compound.

Type:

a-Organic compounds:

The compounds containing carbon, oxygen and hydrogen except CO, CC_2, HCO_3, $CO_3C\backslash N$ and Carbide are called Organic compounds.

Example:

Carbohydrates, protein fats etc.

B. Inorganic compounds:

The compounds except organic compounds are called inorganic compounds.

Example

H_2O, CO_2etc **iii.**

Organelles level:

Different bio molecules combine in a particular way to form the sub cellular structure called organelles. Each organelle performs a particular function.

Example:

Mitochondria provide energy to cell. Ribosome prepares proteins. **iv.**

Cellular level:

It is the basic structural and function unit of all living organisms.

Example:

In unicellular organism a single cell makes the whole body like amoeba. While in multicellular Organisms consists of trillion of cells like human beings, plants etc.

v. Tissue:

In multicellular organisms' similar cells which perform similar function reorganized into group called tissue.

Example:

Plant tissue: epidermal tissue, ground tissue, mesophyll tissue etc. **Animal's Tissue:**

Nervous tissue, muscular tissue, glandular tissue **vi.**

Organ:

More than one type of tissues combines together to perform a specific activity Such group of related tissues is called an organ.

Example:

Kidney, liver stomach, etc. **vii.**

Organ system:

Different organs combine together to perform related function to form an organ system.

Example:

Digestive system Respiratory system etc.

viii. Organism

Different organ system combines to form a whole organism. In an organism the function of different organ system is coordinated.

Example

In case of man, different organ systems such as blood circulatory system respiratory system, digestive system etc work in coordination.

ix. Species:

A group of similar organisms that can interbreed and produce fertile off spring is called species.

Example:

Human, Brassica

x. Population:

A group of organisms of the same species living together in the same place at the same time is also called population.

Example:

Human population and maize population **xi.**

Community:

Different populations interacting with one another in a given Habitat form community **Example:** Desert community consists of lizard, snakes, mice, Rabbit, birds etc. **xii.**

Ecosystem:

The natural area where the living organism and their environment interact and exchange materials between them is called ecosystem.

Example:

Desert ecosystem, pond ecosystem etc

xiii. Biosphere:

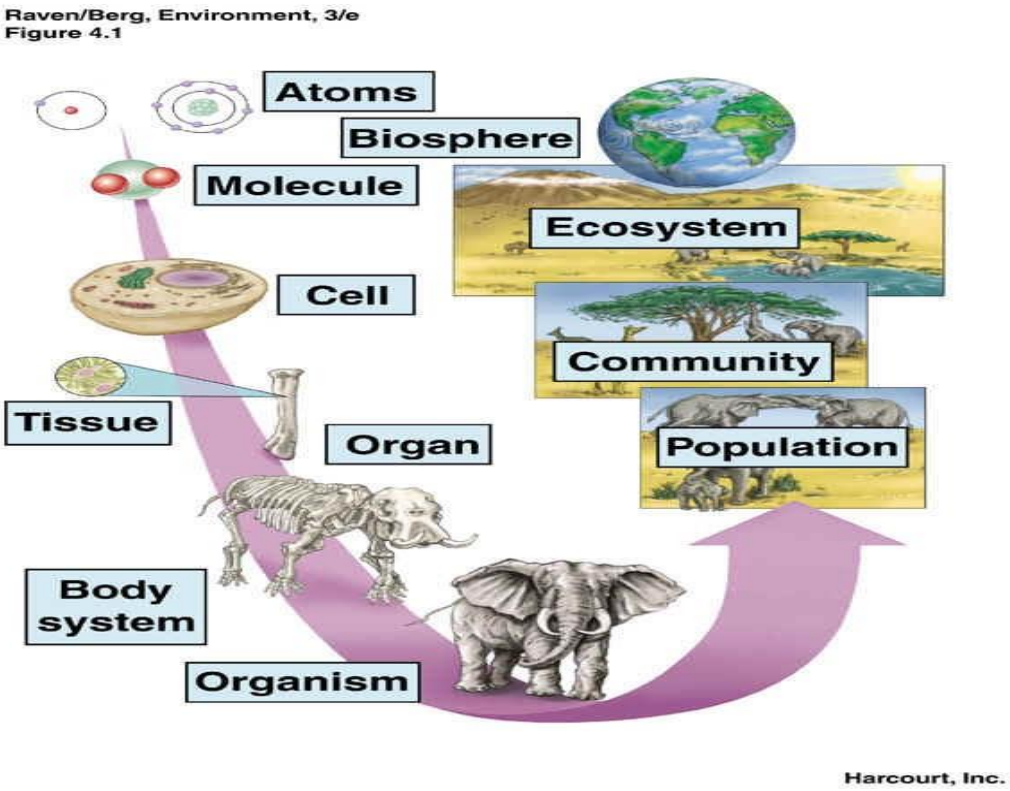
The part of the earth in which life exists including land, water, and atmosphere. It is also called zone of life on earth.

Basic zones of biosphere:

There are three basic zones of biosphere.

a. **Lithosphere:**
   It is the solid portion of the earth surface.
b. **Hydrosphere:**
   It is layer of the water
c. **Atmosphere:**

It is the gaseous portion surrounding the earth.



Q (8): Define cellular organization? Describe various type of cellular Organization. Ans:
Cellular Organization:
Definite:
In living organisms' single cell or many cells organize to form an organism called cellular organization.
Type of cellular organization:
There are three types of cellular organization.

i. **Unicellular Organization:**

The organisms made from a single cell are called unicellular organisms. In unicellular organisms all of the life activities have the division of labour among different organelles. Their single cells are capable of respiration, digestion, excretion, reproduction etc.
Example:
Euglena, Amoeba and Paramecium etc.

ii. **Colonial organization:**

Many unicellular organisms live in the form of colony are called colonial organization. Each unicellular organism in a colony lives its own life and does not depends on other cells for its vital requirements.
Example:
Volvox is a green alga found in water that shows colonial organization. Hundreds of volvox cells make a small volvox colony.

iii. **Multicellular organization:**

Multicellular organisms are made from more than one cell. These cells are organized in the form of tissues, Organs and organ system.
Example:

Mustard plant and frog are familiar example etc.

Mustard plant:

Botanical name:

Brassica campestris.

Plant body: plant body is divided into two parts.

a. **Vegetative parts:**

Those part which do not take plant in sexual Reproduction.

Example:

Roots, stems, branches, leaves.

b. **Reproductive parts:**

It takes parts in the sexual Reproduction of plant.

Example: Flowers.

Frog:

Zoological name: Rana tigrina

The body of frog consists of well- developed organ system these organs system work together in close coordination.

Example:

Digestive system, respiratory system, blood circulatory system, nervous system, reproductive system etc.

EXERCISE MULTIIPLE CHOICE QUESTIONS

A. Encircle the best suitable answers.

1. Ms Aisha was busy in dissecting and analyzing the heart of frog probably she is

a. Cell biologist b. taxonomist c. **Histologist** d. palaeontologist

2. How many people get lung cancer by smoking? This question can be answered through:

a. Biometry b. biophysics **c. Bio – economics** d. palaeontology

3. Al.Qanun-fil-Tibb is the famous book of:

a. **Bu Ali sina** b. Jabir Bin Hayyan c. Abdul Malik Aasmai. Ibn Nafees 4. One of the following contains large number of cells but not a multicellular.

a. Frog **b. Volvox** c. mushroom d. Chlamydomonas

5. According to five kingdom system of classification mushrooms belong

a. Plantae **b. Fungi** c. Animalia d. Protista

6. The level of organization which is represented by the heart of frog is:

a. **Organ** b. Tissue c. Organism d. Organelle

7. One of the following is not a macromolecule:

a. Glucose **b. Sucrose** c. Fatty acid d. protein

8. The number of plants in desert are scarce this could be the statement of:

a. Palaeontologist b. Social biologist c. **Biogeographic** d. Taxonomist 9. Which bio-element makes most of the composition of organism's body?

a. Hydrogen b. Carbon c. **Oxygen** d. nitrogen

10. Which of the following cellular organization represents volvox?

i. Unicellular b. Multicellular c. Bi-cellular d. **Colonial**

SHORT QUESTION

Q1. How the understanding of physics can help the biologist? Ans:

Biophysics:

Definition:

The study of biological processes using the principles of physics is called Biophysics.

Development:

The understanding of physics for a biologist help is using the principles and techniques of physics.

In biological phenomena Biophysics developed after world war II.

Example:

- There is similarity between the working principles of lever in physics and limbs of animal in Biology.
- Use of x-ray, MRI, CT scan for diagnosis purpose.
- Used in physiology, bioenergetics, neurosciences and pharmacology etc. **Q.2: Which career would you like to adopt after studying biology and why?**

Ans. I want to become a medical doctor and serve the humanity. Being a doctor, it is very honourable and responsible profession. I want to do specialization in cardiology because heart diseases are very common now and a lot of people die of it. That is why I will prefer medical profession for carrier.

Q3. Write the translation of any three verse of the holy Quran related to the creation of mankind?

Ans: See Q No.5

Q4. Name few Muslim scientists and their contributions in the field of biology and Medicine?

Ans: See Q No. 6

Q5. What level of organization is represented by Volvox?

Ans: Volvox represents colonial organization. In colonial organization many unicellular organisms live in the form of a colony.

Habitat:

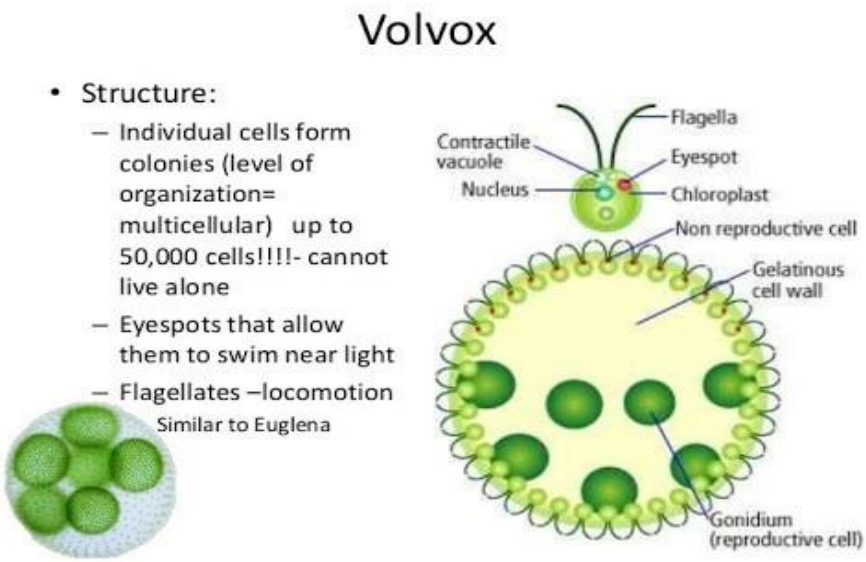
Volvox is a green algae found in water.

Size:

Each colony is the size of pin-head.

Number of cells:

There are 500 to 60000 cells presents in a single colony. The cells are connected to each other by Cytoplasmic strands. Vegetative cells are ciliated and are concerned with nutrition and locomotion.



LONG QUESTION

Give Detailed answers to the following Questions.

Q1. Briefly establish the linkage between biology with physics geography and statistics?

Ans: See Q.2

Q2. Define biology How can you describe your own body under different branches of biology?

Ans. See Q.1

Q3. Enlist the various levels of biological organization and explain it with an example?

Ans. See Q No Q 5

Q4. Explain the role of Bio-elements for living organisms?

Ans. Bio elements:

Definition:

The elements which make the body mass of a living organism are called Bio-element. Out of 92 natural occurring elements. In these 16 Bio elements only six elements oxygen, carbon Hydrogen, Nitrogen Calcium and phosphorus make 99 % of the total mass of protoplasm while other ten bio elements potassium Sulphur, Chorine, sodium, magnesium, iron, copper, manganese, zinc and iodine make 1% of the total mass of protoplasm.

i. Oxygen = 65% **ii.** Carbon = 18% **iii.** Hydrogen = 10% **iv.** Nitrogen = 03% **v.** Calcium = 02% **vi.** Phosphorous = 01% **vii.** Other ten element = 01%

Importance of Bio elements: i. Hydrogen:

Important elements of water and organic compounds **ii.Oxygen:**

Essential for Aerobic Respiration, breathing, growth, Reproduction and heredity.

iii.Carbon:

It is a key element of organic compound and carbon dioxide e.g. CH_4, CO_2 **iv.Phosphorous:**

- It is essential for growth of roots.
- It promotes fruit ripening.
- It gives rigidity to the bones and teeth.
- It is an important component of ATP, DNA, RNA and phospholipids. v.Calcium:
- It plays an important role in bones development ➢ It is also essential for tooth formation.
- It is responsible for holding together the cell walls of plants.

VI. Sulphur:

- It is essential components of vitamin B1(thiamine) ➢ Sulphur is a key component in most proteins.
- It is also essential for the synthesis and break down of fatty Acids.

vii.Nitrogen:

It plays important role in metabolism, growth, Reproduction and heredity.

viii.Sodium:

Sodium helps control blood pressure and regulates the function of muscles and nerves.

ix.Potassium:

It is essential for the process of photosynthesis and respiration

x. Magnesium:

It is an important component of chlorophyll. It acts as activator for enzyme in carbohydrates metabolism. **xi.Manganese:**

The best function of manganese is in the reaction in which oxygen is produced from water during the process of photosynthesis.

xii.Iron:

It plays important role in the formation of Haemoglobin.

Haemoglobin:
Transport oxygen to all body cells. **xiii.Copper:**
It is essential for photosynthesis **xiv.Zinc:**
In plants it is required for chlorophyll synthesis. While in animal it plays important role in growth. **xv.Iodine:**
it plays a role in the production of thyroxin hormone.
Thyroid gland:
It is a gland present on the front of trachea it secretes a hormone called thyroxin hormone.
Function:
It regulates growth, maturation, sexual and mental development.
xvi.Chlorine:
Chlorine is required for the water-splitting reaction of photosynthesis in which oxygen is produced. It is also required for cell division in leaves and roots.
Q5. Who classified the living organisms into five kingdoms? Explain each kingdom with the living organisms included in it.
Ans: See Question 4

CHAPTER NO 2.
SOLVING A BIOLOGICAL PROBLEM

Q1: What is science? How does science work?
Ans: Science: Meaning:
The word science is derived from Latin word "Scientia" meaning knowledge.
Definition:
The knowledge which is based on observation and experiment is called science. **Scientific method:**
A systematic method uses to solve a problem with the help of observation, information and experimentation is called scientific method.
Science work:
In science first observation is done and then after observation experiment in conducted to check the reality of the observation.
Q2: What is Biological method? Give its importance.
Ans: Biological method: Definition:
The scientific method, in which biological problems are solved is termed as biological method.
Importance:
It has played a very important role in biological research from the last 500 years. It has contributed a lot to the progress of biology and up to the current Advancement in all the biological fields such as medicine, ecology and technology etc.
Steps of Biological method:
For solving biological problem, biologists take the following steps.
Step (1): Recognition of biological problem:
Biologists go for adopting biological method when they encounter some biological problem. A biological problem is a question related to living organism. It either asked by someone or comes in biologist mind by himself.
Step (2): Observation and previous research:
After recognizing the biological problem. The biologist makes observation. He also recalls his old observation and also studies previous research on the same problem.
Observation are made with five senses i-e, vision, hearing smell, taste and touch. There are two type of observation.

S/No	Quantitative Observations	Qualitative Observation
1	It deals numbers	It deals with description
2	It can be measured	It can be observed but not measured
3	Length, height, area, temperature, volume, weight, cost etc	Colour, texture, smell, taste etc

4	**Examples:** The freezing point of water is $0C^0$ and the boiling point is 100 C^0 A liter of water weight 1000 grams and liter of ethanol weighs 789 grams	**Examples:** The freezing point of water is colder than the boiling point. A liter of water is heavier than a liter of
		ethanol.

Step (3): Hypothesis:

Hypothesis is an unaltered before experimentation "so tentative explanation of observation is called hypothesis" Biologist reasoning to formulate a hypothesis. Hypothesis consists of two type reasoning

I. Deductive Reasoning (deduce – take away from total):

Deductive Reasoning is the observation from general to specific.

Example:

If all organisms have cells and human is also an organism then conclude that human should have cells.

II. Inductive Reasoning (induct-lead in):

Inductive reasoning is the observation from specific to general.

Example:

We observe cell in Micro-Organisms so we can conclude that all living organism have cell in their body

Characteristic of a good Hypothesis:

- It is based upon observation made by the biologist ➢ It is a proposed statement to answer the problem.
- It is testable through experiments.
- It should be kept as simple as possible.
- There is always a way to disprove the hypothesis after experimentation.

Step (4): Deduction:

In this step biologist draw deduction from hypothesis deduction is the logical consequences of hypothesis as true and draw out the expected results called deduction. It involves the use of "if" and "then".

Example:

If all birds have wings then pigeon is a bird **Step**

(5): Experiment:

The most important thing of biological method is experimentation. Biologist perform experiments on his hypothesis and checks the deductions.

Through experiment he can find that deduction of some hypothesis has come true while others have not. In this way, the hypotheses are proved as true or false hypothesis are rejected while the true ones are accepted.

In science when doing the experiment, it must be a controlled experiment. The scientist must contrast an experimental group with a control group.

For example,

- Experimental group (patients)
- Control group (Healthy person) **Step 6: Conclusion and Reporting:**

Biologist collects data from his experiments. He analyze the data statistically to reach some conclusion. He publishes his conclusion in the form of research articles in scientific journals and books. Publishing of result is an essential part of scientific method.

Q3. Describe the steps involved in biological method taking malaria as an example?

Ans: Malaria

Malaria is a common disease in many countries including Pakistan.

Naming:

The word malaria is the combination of two Italian words:

- "Mala" Mean
- "Area" Mean "air"

Biological problem 1: what is the cause of Malaria Step 1: Observation:

- Malarial patient experienced recurring attacks of chills and fevers.
- The disease was more common among people who lived in low marshy area.
- Drinking the water of marshes does not cause malaria.

These observations did not help much for solving the problem i-e "what is the cause of malaria" In 1878 a French physician Laveran examined the blood of a malaria patient under microscope. Five year late, the same microorganisms were observed in the blood of malaria patient and these microorganisms were given the name of **"Plasmodium" Step 2: Hypothesis and Deduction: Hypothesis**

Biologist further build upon the ancient observation and the discovery of Laveran the hypothesis made in this case was,

"Plasmodium is the cause of Malaria" **Deduction:**

Biologist does not know whether his hypothesis is true or not, but he accepts it may be true and make deduction. One of deduction from above hypothesis was,

If plasmodium is the cause of malaria, then all malarial patients should have plasmodium in their blood

Step 3: Experiment and Result:

Experiment:

The next step was to test the deduction through experiments which were designed as, "Blood of 100 malaria patient was examined under microscope. For the purpose of having a control group, the blood of 100 healthy persons was also examined under microscope" **Result:**

It was observed that all the malarial patients have plasmodium in their blood; whereas the blood of healthy persons was free from plasmodium.

Step 4: Conclusion

The result was quite convincing and proved that the hypothesis "Plasmodium is the cause of malaria" was true.

Biological problem 2: How is plasmodium transmitted to human beings?

Step 1: Observation:

Biologist were having following observations

- Malaria is associated with marshes
- Drinking water of marshes does not cause malaria.

From these observations it can be concluded that plasmodium was not in the marsh water. But it must be carried by something that comes to marsh water.

In 1883 a physician A.F.A king listed twenty observation. Some important observation of A.F.A king were:

- People who slept in open places suffered from malaria more than the people who slept indoors.
- Individuals who slept near a smoky fire usually did not get malaria.
- Those people who used mosquito nets suffer less from malaria as compared to those who did not use mosquito nets.

Step 2: Hypothesis:

On the basis of this observation king suggested a hypothesis:

"Mosquitoes transmit plasmodium and so are involved in the spread of malaria **Step 3:**

Following deductions were made considering the hypothesis as true:

"If mosquitoes are involved in the spread of malaria then, plasmodium should be present in mosquitoes" OR

"A mosquito can get plasmodium by biting a malarial patient"

Step4: Experiment:

Ronald Ross was British army physician who worked in India 1880s. He performed important experiment to test the above deduction He allowed a female Culex mosquito to bite sparrows suffering from malaria. Some of the mosquitoes were killed and studied at various time Ross found that plasmodium multiplied in the wall of the mosquito's stomach and then moved into mosquitoes salivary glands. He kept some mosquitoes need the blood of mammals or birds for the maturation of the eggs. Ross found that the saliva of the infected mosquito contained plasmodium and in these previously healthy sparrows, he found many plasmodium. **Result:**

It was observed were sparrows had plasmodium in their blood.

Step 4: Conclusion:

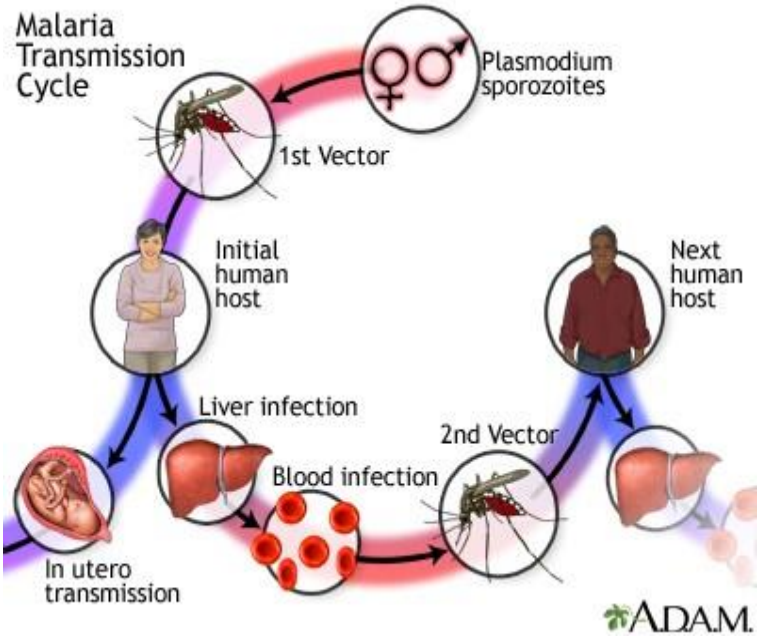
The results were quite convincing and proved that the hypothesis "How plasmodium transmitted to human beings" was true.

Q4: Explain the experiment of malaria on Human?

Ans. In the end hypothesis was tested by direct experimentation human beings. In 1898 Italian biologists allowed an anopheles mosquito to bite a malarial patient. The mosquito was kept for a few days and then it was allowed to bite a healthy man. This person late got malaria. In this way, it was confirmed that mosquitoes transmit plasmodium and spread malaria.

Transmission of plasmodium:

When a female mosquito pierces the skin with her mouthparts, she injects a small amount of saliva prevents the blood from clotting in her food canal.



Q5: Write a comprehensive definition of theory, law or principle. Ans:

Theory: -

When more research is carried out on a hypothesis and all the available evidence favours it, then it becomes theory. **Explanation: -**

We know that when a hypothesis has been proved by experiments. Scientists keep on trying to do more experiments on it. When a hypothesis is proved by many experiments, scientists develop more hypothesis is proved by many experiments, scientists develop more hypotheses from it and test them experimentally, If the new hypotheses are again proved the original hypothesis becomes a theory.

Example: -

- Darwin theory about evolution
- Lamarck theory about evolution

Law or scientific principle: -

When a theory is accepted again and again and become a universal truth is called law. It must be simple, universal and absolute.

Explanation: -

Many biologists take it as a challenge and exert greater efforts to disprove the theory. If a theory survives such doubtful approach and continues to be supported by experimental evidences, it becomes law or principle. A scientific law is a uniform or constant fact of nature.

Example:

Hardy Weinberg principle and Mendel's laws of inheritance.

Q6: Discuss data organization and data Analysis?

Ans: Data organization and data analysis are important steps in the biological method.

Data organization: Data;

Data can be defined as

"Data can be defined as

"A piece of information such as name, date or values taken from observation and experimentation"

In order to formulate and then to test the hypotheses scientist collect and organize data through the use of variables and controls, results can be determined. **a. Variable:**

Variable are those factors being tested in an experiment and usually compared to a control.

control;

A control is a known measure to which scientist can compare their results. Prior to conducting an experiment, it is very important for a scientist to describe the data collection methods. It ensures the quality of the experiment. Data is organized in different formats like graphics, tables, flow charts, maps and diagrams.

Data analysis;

Data analysis is necessary to prove or disprove hypothesis by experimentation. The methods involved in testing or analyzing the data are also important since an experiment should be repeated by others to ensure the quality of results. Depending on the type of data and the biological problem, this might include application of statistical methods i.e., ratio and proportion.

a.Ratio:

When a relation between two numbers e.g. 'a' and 'b' is expressed in terms of quotient (a/b), such a relation is the ratio of one number to the other. A ratio may be expressed by putting a division (÷) or Colon (:) mark between the two numbers.

Example:

The ratio between 50 malarial patients and 150 normal persons is 1: 3.

proportion:

Proportion means to join the equal ratios by the sign of equality (=). **Example:**

a: b = c: d

is a proportion between the two ratios. This proportion may also be expressed as

a: b:c: d.

In every proportion of two ratios have four terms i.e., the first and forth terms are called extremes, the second and third are called means.

So, in the above proportion 'a' and 'd' are extremes while 'b' and 'c' are means. The basic rule used to solve problems through ratio and proportion is that the product of the extremes is equal to the product of means. When three values in a proportion are known, the fourth one (X) can be calculated by using this rule.

Example: -

If a biologist wants to know how many sparrows would be infected with malaria if he allows Culex mosquito to bite 50 sparrows. Previously in one of his findings he already noticed that if allowed Culex mosquito to bite 10 sparrows 6 out of them got malaria.

Rule: **a: b:c: d**

Sparrow: -

10 ——— 6

50 x

10x = 50 × 6

Dividing both sides by 10.

$$\frac{10xx}{\cancel{10}} \qquad \frac{300^{30}}{\cancel{10}}$$

$$10 \quad 10$$

$$x = 30$$

It means that 30 out of 50 sparrows will get malaria. Proportions are used to draw the conclusion.

Q7: what is the relationship of biology with Mathematics?

Ans: Mathematics as integral part of science:

Mathematics is used in biology in many fields.

Applied mathematics:

Biological method also involves the use of applied mathematics to solve biological problems. Major biological Problems in which knowledge of mathematics is used include gene finding, protein structure and the modelling of evolution **Bioinformatics:**

Bioinformatics refers to the use of algorithms, computational and statistical techniques for the analysis of biological data. Computational biology refers to hypothesis driven investigation of specific biological problem using computer **For Example:**

It is used for calculation in Human genome project. This project is used to determine the gene sequence of a particular organization. Mathematics is also used in ecology and evolution.

SHORT QUESTION

B. Give short answers to the following question?

Q1. What is science? How does science work?

Ans. See Q NO 1

Q2. Control group is important for scientific study, How?

Ans. Control group:

It is a group that remains constant throughout the experiment to test a hypothesis. But other variables are compared with it.

Importance:

1. To find more accurate and acceptable result of the experiment.
2. To compare the result with it.
3. To know the effect of treatment.

Q3. What deductions were developed during the study of Malaria?

Ans. Biologist does not know whether his hypothesis is true or not, but he accepts it may be true and make deduction.

i. "If Plasmodium is the cause of malaria, then all malarial patients should have plasmodium in their blood"
ii. "if mosquitoes are involved in the spread of malaria then Plasmodium should be present in mosquitoes"
iii. "A mosquito can get plasmodium by biting a malarial patient"

Q4: How Ronald Ross conducted the experiment to prove that mosquitoes are involved in the spread of malaria? Ans: Ronald Ross Experiment:

Ronald Ross was a British army physician who worked in India in 1880's. He performed important experiment to test the above deduction. He allowed a female Culex mosquito to bite sparrows suffering from malaria. Some of the mosquito were killed and studied at various times. Ross found that Plasmodium multiplied in the wall of the mosquito's stomach and then moved into mosquitoes salivary glands. He kept some mosquitoes alive and allows them to bite healthy sparrows. Female mosquitoes need the blood of mammals or birds for the maturation of their eggs. Ross found that the saliva of the infected mosquito contained Plasmodium and these entered the sparrow's blood. When he examined the blood of these previously healthy sparrows, he found many Plasmodium's.

Q5: At what stage of the biological method, Hypothesis, is accepted or rejected?

Ans: The stage of biological method, in which hypothesis is accepted or rejected is experiment. The most basic step of biological method is experimentation. After experimentation the incorrect hypothesis are rejected and the one which proves correct is accepted.

LONG QUESTION

Give Detailed answers to the following Questions.

Q1: Differentiate between inductive reasoning and deductive reasoning?

Ans: See Q No. 2

Q2: Explain how biologists use scientific method to solve the mysteries of addressing the malarial problem?

Ans: See Q No. 3

Q3: Explain that how mathematics can be used to interpret the data obtained through experimentation.

Ans. See Q No. 6(See ratio, proportion and solved example)

CHAPTER NO 3.

Biodiversity

Q (1): What is biodiversity? Write its importance. Ans:

Biodiversity: -

Meaning: -

The term biodiversity has been derived from two Greek words.

- **Bio** mean life.
- **Diversity** mean variety within a species or among a species. **Definition: -**

The different kind of organisms such as plants, animals and microorganisms present in different ecosystems of the world is called biodiversity.

Explanation: -

There are two million organisms which have been identified. Out of these two million 1.5 million are animals and 0.5 million are plants. In Pakistan there are about 60000 kinds of plants and 23,000 types of animals.

Biologist estimated that today's global biodiversity may consist of more than 100 million kinds of organisms. The biodiversity of an area depends on climate, altitude and composition of soils etc. Tropical regions of the earth have richer biodiversity while Polar Regions have fewer species.

Importance of biodiversity: - i.

Food for human beings:

Biodiversity provides food for human in the form of different crops, fruits, meat, eggs and milk etc. ii. **Production of drugs:**

Biodiversity plays a vital role in human and animal's health. A wide variety of plants, animals and fungi are used as medicine and essential vitamins. Drugs such as streptomycin and Erythromycin are derived from fungi drugs like caffeine, morphine and quinine are produced by other plants. iii. **Industrial benefits of biodiversity:**

Biodiversity plays an important role in the production of industrial materials. Building materials, fibres, dyes, resins, gums, rubber and oil are some of the industrial materials derived from the plants.

iv **Relation with ecosystem;**

Biodiversity play an important role in making and maintaining ecosystem. It is directly involved in recycling of nutrients and providing fertile soil.

Q (2): - Define classification? Explain the aims and principles of classification. Keeping in view its historical background?

Ans: - Classification:

The arrangement of organisms into group and sub group on the basis of their similarities and differences is called classification.

Biologist have identified or described about 2 million kinds of organism (0.5 million type of plants & 1.5 million of animals) **Basis of Classification:**

i. Aristotle classified organisms on the basis of habitat. For example, fish and turtle cannot be placed in one group. ii. classification is also based on relationship among organisms and such relationship is got through similarities in characteristics. These similarities suggest that all organisms are related to one another at same point in their evolutionary histories. iii. Later biologists begun to classify organism on the basis of physical characteristics. Some of the characteristics which are used to classify organisms are as follows.

- Prokaryotic or eukaryotic cell
- Unicellular or multicellular organism
- Autotrophs or Heterotrophs iv. Modern system of classification is based not only on morphology of organism but the similarities and differences in the DNA of the two organisms can be used for getting idea about their structure and function.

Aims of classification: -

i. To determine the similarities and difference among organisms.

ii. It makes easier to study the number of species. iii. To find interrelationship among organisms. iv. To name and place the organism in a proper place. v. to study an organism systematically.

Principles of Classification: -

Biologist follows certain principles for classification. A few of the principles are:

i. Organisms are classified on the basis of their apparent similarities such as colour, height, and weight etc. ii. On the basis of internal structure and stages of development.

iii. When they have more homologous structure. iv.

Evolutionary history is also considered during classification.

v. Genetics and Biochemistry of different organism are also considered as principle for classification.

Q. (3): What is Hierarchy of taxonomy? Discuss various categories of hierarchy.

Ans: Hierarchy of taxonomy: -

The arrangement of different organisms in their respective group called taxa. The taxa form a ladder called taxonomic hierarchy.

Various categories: -

All organisms are divided into five kingdoms. So, kingdom is the largest taxon. On the basis of similarities, each kingdom is further divided into smaller taxa in the following way. **i) Species: -**

A specie consists of similar interbreeding organism.

Example: Pardus.

ii) Genus: -

A genus is a group of related species.

Example: Panthera **iii) Family: -**

A family is a group of related genera.

Example: Felidae **iv) Order**: -

An order is a group of related families.

Example: Carnivora **v) Class: -**

A group of similar order makes up a class.

Example: Mammalia **vi) Phylum: -**

It is a group of related classes.

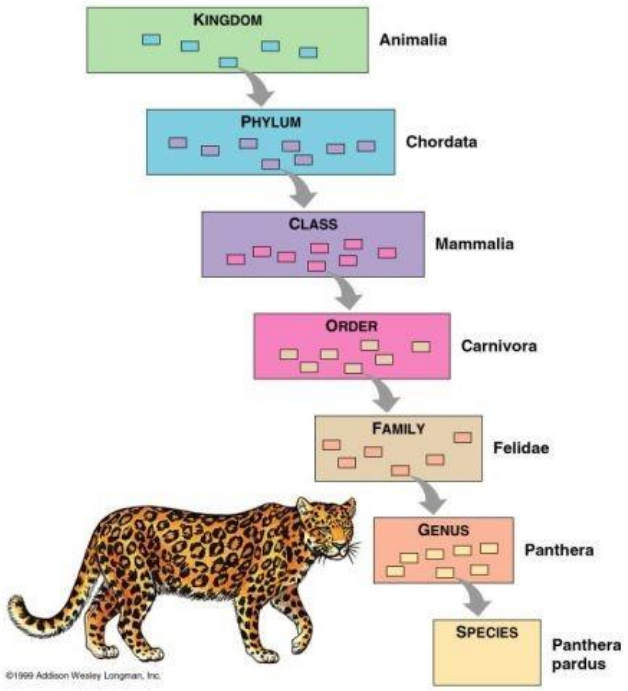
Example: Chordata **vii)**

Kingdom: -

The related phyla group together to form kingdom.

Example: Animalia

Each category is called taxon. Members of the lower taxon resemble one another more than the members of a higher taxon.



Q (4): Write the taxonomic hierarchy of Amoeba, Mustard, Mushroom, man and panther?

Ans: Taxonomic hierarchy:

The arrangement of different organisms in their respective group called taxa. The taxa form a ladder called taxonomic hierarchy.

Taxa	Amoeba	Mustard	Mushrooms	Man	Panther
Kingdom	Protista	Plantae	Fungi	Animalia	Animalia
Phylum	Protozoa	Tracheophyte	Mycota	Chordate	Chordate
Class	Sarcodina	Angiospermae	Basidiomycota	Mammalian	Mammalian
Order	Ameobidale	Brassicales	Agaricales	Primates	Carnivora
Family	Amoebidae	Brassicaceae	Agaricaceae	Hominidae	Felidae
Genus	Amoeba	Brassica	Agaricus	Homo	Panther
Species	Amoeba Proteus	Brassica campestris	Agaricuscampestris	Homo sapiens	Pantherapardus

Q (5): Discuss the old history of classification?

Ans: - History of Classification: i)

Aristotle Classification:

Aristotle was a Greek philosopher and scientist in 4th BC. He classified plants and animals on the basis of similarities.

a. Plant Classification: Aristotle classified plants into

i) Herb ii) Shrubs iii) Trees

b.Animal Classification: Aristotle classified animals into

i) Aquatic animals ii) Terrestrial animals.

ii) Abu Usman Umer Al-jahiz:

Date of Birth: He was born in Basra in 776 A.D.

Contribution: He described the life system of ants and his own observation on seasonal migration of fishes in river Tigris.

Book:

Al-Jahiz wrote a book Kitab-Al-Hayawan on animals which described the characteristics of 350 species of animals. In this book he also discusses animal mimicry, communication, physiology, degree of intelligence and their geographical region etc.

Q(6): Discuss two kingdom system of classification? Write the reason of its failure.

Ans: - Historical background: -

The two-kingdom system of classification was presented by a Swiss scientist Carolus Linnaeus in 1753. According to two kingdom system of classification all living organisms are classified into:

i) Kingdom Plantae ii)Kingdom Animalia

i) Kingdom Plantae: -

Kingdom Plantae included all green plants, algae, fungi and bacteria. **ii)Kingdom Animalia: -**

Kingdom animalia included all unicellular and multicellular Animals.

Failure / Limitations:

i. Dual organisms are placed in kingdom plantae such as euglena and Chlamydomonas. Both these have plants as well as animals like characteristics. **ii.** This system did not clear the

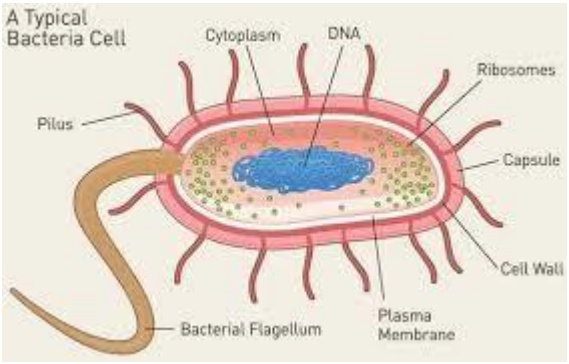
difference between prokaryotes and eukaryotes. **iii.** Fungi were place in kingdom plantae but new discoveries also proved that fungi are very different from plants.
On the basis of these limitations five kingdom system of classification was proposed.

Q (7): Discuss five kingdom system of classification.
Ans: - According to "Five Kingdom system of classification" all living organisms are classified into five kingdoms. In 1969 Robert Whittaker introduced this system. These five kingdoms are,

I) Kingdom Monera: -

Characteristics: -

i. They contain prokaryotic organisms.
ii. All these organisms are unicellular and microscopic. **iii.** Nuclear membrane and membrane bounded organelles are also absent.
iv. Their Cell Wall is made up of murein (sugar + amino acid also called peptide glycan)
v. They are simplest of all living organisms. **Examples:**
Bacteria, blue green Algae (cyanobacteria).

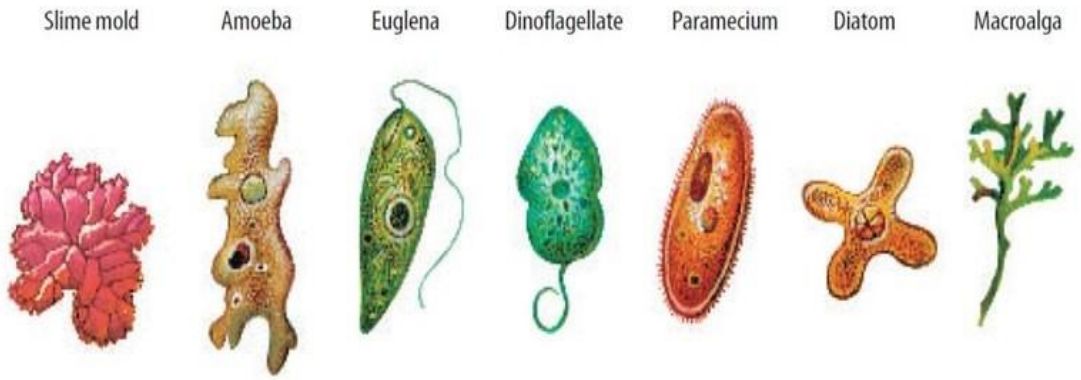


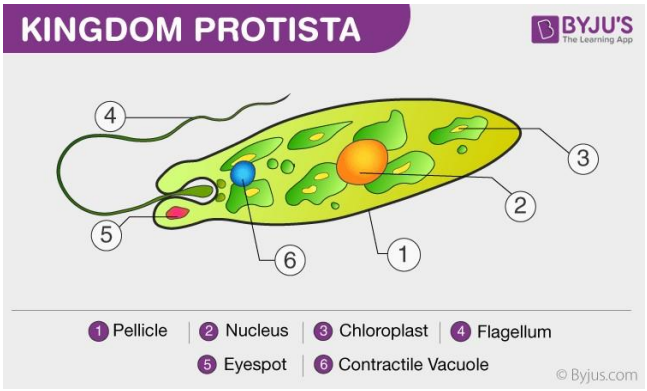
II) Kingdom Protista (Gr; Protista-very first): -

Characteristics: -

i. It includes eukaryotic unicellular and simple multicellular organisms.
ii. Usually live in aquatic habitat.
iii. Some contain chlorophyll and prepare their own food while some lack chlorophyll and cannot prepare their own food. **iv.** Some organisms are plant like, some are animal like and some are fungus like. **Examples: -**

Plant like → Chlamydomonas
Fungus like → Slime molds. Animal Like → Amoeba etc.





III) Kingdom Fungi: -

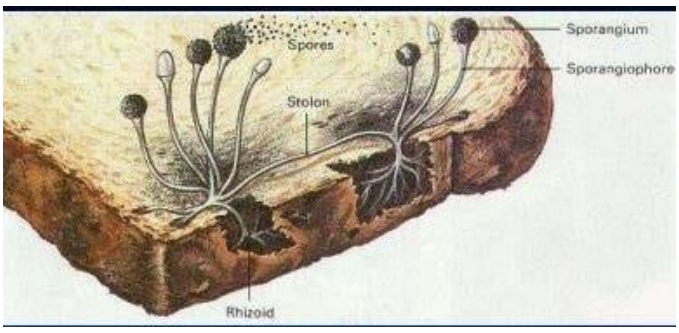
Characteristics: -

i. They are eukaryotic multicellular organisms.

ii. They are heterotrophs because they cannot synthesize their own food. **iii.** The food is stored inside the body in the form of glycogen. **iv.** Their cell wall is made from chitin.

v. They take their food by absorption (saprophyte). **Example: -**

Bread mold, Mushroom, puffballs and yeast etc.



IV) Kingdom Plantae: -

Characteristics: -

i. They include eukaryotic multicellular organisms.

ii. They are autotrophic and can prepare their own food by the process of photosynthesis. **iii.** Their cell wall is made of cellulose. **iv.** Mostly lack centrioles inside their cells.

v. The reserve food is in the form of starch.

IV) Kingdom Animalia: -

Characteristics: -

i. They include eukaryotic multicellular animals.
ii. Centrioles are present in the cells. **iii.** They have no chlorophyll and cannot prepare their own food. **iv.** This kingdom contains both vertebrates and invertebrate animals. **Example: -**
Vertebrates: They have back bone e.g. Fish, birds, mammals etc.
Invertebrates: - They have no back bone e.g. insect, Ant, Jellyfish, worm etc.

Q (8): Discuss the comparison between two kingdom and five kingdom system of classification?

S/No	Two Kingdom System	Five Kingdom System
1	It was proposed by Carolus Linnaeus in 1751.	It was proposed by Robert Whittaker in 1969.
2	Organisms are classified into two kingdoms.	Organisms are classified into five kingdoms.
3	It is based on nutrition and motility.	It is based on the cell structure, complexity of body, mode of nutrition and evolution.
4	The Placement of organisms like Euglena, Bacteria, Fungi in plantae is questionable due to certain reasons.	Organisms are better placed on the basis of body, cell structure and evolution.

Q (9); Write a distinguishing characteristic of the five kingdoms of living organisms? Ans: Distinguishing Characteristics of the five Kingdoms of life:

Kingdom	Cell Type	Nuclear Envelope	Cell wall	Mode of Nutrition	Multicellularity
Monera	Prokaryotic	Absent	Non-Cellulose	Autotrophic or heterotrophic	Absent
Protista	Eukaryotic	Present	Present in some forms, various types	Photosynthetic or heterotrophic, or combination	Absent in most form
Fungi	Eukaryotic	Present	Chitin	Absorption	Present in all forms
Plantae	Eukaryotic	Present	Cellulose and other Polysaccharides	Photosynthesis	Present in all forms
Animalia	Eukaryotic	Present	Absent	Ingestion	Present in all forms

Q (10) What is Virus? Discuss their structure? Ans:

- Virus: -

Discovery: -

It was first discovered by a Russian scientist lvanovskyin 1892. **Meaning: -**

The word virus is derived from Latin word "venom" which means poisonous fluid. **Definition: -**

Viruses are non-cellular unique particles at the borderline of living and non-living organism. Study of virus is called virology.

Structure of Virus: -

The virus consists of two main parts. i)
Outer protein coat called capsid.
ii) The inner nucleic acid core contains DNA or RNA.

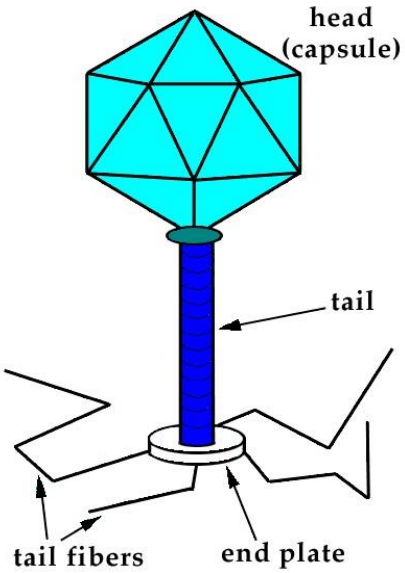
Difference between living and non-living characters:

Living characteristics:

i. They can reproduce inside the host cell (obligate parasite) ii. They contain nucleic acid either DNA or RNA as hereditary materials. iii. They can grow inside the host cell. iv. They cause diseases in living organisms.

Non-Living characteristics: -

i. Viruses cannot live without a host cell and can be crystallized.
ii. They can be crystallized outside the host cell. iii. They cannot Respire. iv. They cannot excrete.



Q (11): Explain binomial nomenclature and its rules? Discuss its importance.

Ans: - Meaning: - ➢ Bi means two,

➢ Nominal means names.

So, binominal nomenclature is the method of giving scientific names to living organisms.

Introduction: -

It was developed by a Swedish biologist Carolus Linnaeus 1757. According to binomial nomenclature all living organism have a particular name consist of two words. The firs name refers to the Genus and the second name refers to the species. That is why this system is known as two words naming system.

Examples: -

HomoSapiens is the zoological name of man. In this name home is the genus and Sapiens is the specie.

Importance of binomial nomenclature: -

i. These names are more definite and precise than common names. Common name has no scientific basis. **ii**. Being generally in Latin, they have a universal acceptance by people of all languages. **iii**. They are usually descriptive and easier to study. **iv.** They indicate the generic and evolutionary relationships of individual animals and plants.

Rules of Binomial nomenclatures: -

i. Scientific names are usually printed in italic when hand written they are underlined. **ii.** The first term generic and evolutionary relationships or individual animals and plants.

Rules of Binomial nomenclature: -

i. Scientific names are usually printed in italic when hand written they are underlined. **ii.** The first term generic name always begins with capital letter, while the species name is never capitalized. **iii.** The species name is written after genus name.

Examples: -

Mustard	Brassica campestris
Frog	Rana tigrina

Q (12): List down the biological names of some plants and animals.

Ans: - Biological Names: -

Botanical names of some plants: -

Local Name	**English Name**	**Botanical Name**
Nilofar	Blue Water lily	Nymphaea lotus
Tambaku	Tobacco	Nicotianatabacum
Dharek	Neem	Melia azedarach
Surajmukhi	Sun Flower	Helianthus annuus
Lehsan	Garlic	Allium Sativum
PhoolMatar	Sweet pea	Lathyrusodoratus
Shersham	Mustard	Brassica campestris
Ruber	Rubber	Ficuselastica

Pepal	Sacred Fig	Ficusreligiosa
Banyan	Banyan	Ficusbenghalensis

Zoological Names:

Local Name	**English Name**	**Zoological Name**
Makhi	House Fly	Muscadomestica
Zarapha	Girraffe	Giroffacamelopardolis
Kharpusht	Porcupine	Hystixlecura
Bille	Cat	Felisdomesticus
Titlee	Butterfly	Pierisrapae
Kechwa	Earth worm	Pheretimaposthuma
Kutta	Dogs	Canisfamiliaris
Markhor	Markhor	Capra flaconeri
Talor	Talor	Houbara bustard
Lomri	Wolf	Canis lupus
Babar sher	Lion	Felisleo
Bengal Sher	Tiger	Felistigris

Q (13): What do you know about conservation of biodiversity? Why conservation of biodiversity is important?
Ans: Conservation of Biodiversity: - Definition: -
The use of natural resources such as plants, animals, minerals and water in a wise manner is called conservation of biodiversity. **Explanation: -**
Nature has gifted us with natural resources. We need to make wise use of these resources so that their balanced state will not be disrupted.
Importance:
Conservation of resources is necessary to fulfil the needs for the present generation, as well as for the future generation.

Q (14): What do you meant by extinct, threatened and endangered species? Write example with references to Pakistan. Ans: Extinct species;

A Specie that no longer lives in an ecosystem is said to be extinct in that ecosystem.

Extinct Animals in Pakistan:

Asiatic cheetah, tiger, lion, wild ass, Indian one horn rhinoceros, swamp deer, black buck and Hangul etc.

Endangered species:

A specie that is at risk of extinction in near future is called endangered species. In Pakistan 31 species of mammals, 20 species of birds and 5 species of reptiles are endangered.

Endangered Species of Plants:

Rafflesia, yaw, chilghozae and sanobar.

Endangered species of animals:

Houbara bustard(talor), Capra falconeri (markhor) **Threatened species:**

A species which are likely to become endangered in the near future are called threatened species.

Threatened species of animals:

Fishing cat, pallas cat, otter, Snow leopard, Brown bear.

Q (15): Write the impact of human being on biodiversity?

Ans: Negative Impact of Human being on Biodiversity: i. Habitat loss and Deforestation:

Habitat loss means destruction of natural habitat of species.

All Species have specific food and habitat. Human Population increase day by day in order to fulfil the demands of food, people are clearing forests and developing agriculture lands and residential colonies.

Deforestation mean cutting down of trees without proper planning is called deforestation. In Pakistan forests cover only 5.2% of the land. Pakistan has the highest annual deforestation rate in Asia. According to a report of WWF since 1947 more than 151,500 acres of forest land have been converted to non-forest land. **ii. Over – Hunting:**

Illegal hunting of animals causes loss biodiversity. In Pakistan various lizards, snakes, crocodiles and larger mammals are hunted for various purposes. Large number of migratory birds are hunted and killed during their seasonal migration. **iii. Introduction or Removal of species:**

When a new specie is introduced in an ecosystem. It may prove harmful for the existence of their species living there.

a) Introduction of species:

Eucalyptus trees were imported to Pakistan from Australia. These trees consume more water and have disturbed the level of underground water. So other smaller plants cannot grow near these trees.

b) Removal of species:

Starfish eats mussels which are harmful to many other species. If starfish is removed from that ecosystem, the mussels will increase in number and they will harm to other species. **iv. Rapid industrialization:**

The Chemical pollutants released from industries are harmful for species and ecosystem.

Q (16): Define wild life. Describe the conservation of wildlife.

Ans: -Wild Life: - Definition:

-

The non-domesticated animals and non-cultivated plants present naturally in an area is called wild life.

Conservation of wild life: -

We should conserve our wild life by controlling the following dangerous issues.
i. Over population ii. Deforestation iii. Over grazing iv. Urbanization etc.

Q (17): List down the endangered species of Pakistan? And what are the reasons behind their population decrease? Ans: Endangered Species: -

Definition: -

The species which are near to extinct is called endangered species.

Endangered species in Pakistan: - In Pakistan there are:

Mammals	=	31 Species
Birds	=	20 Species
Reptiles	=	5 Species

Examples: -

Some endangered plants species in Pakistan:

Taxusbaccata	(yew)
Pinusgeradiana	(chilghoza)
Juniperus	macropoda (sanobar)

The above plants species have become endangered in Pakistan. **Some engendered animal species in Pakistan**

Capra falconeri (markhor)
Houbarabustard (talor)
Marcopolo Sheep
Musk deer
Dolphin

Reason of population decrease: ➢

Habitat loss and deforestation ➢
Introduction of new species.

- ➢ Over-hunting
- ➢ Pollution
- ➢ Climate change

Q (18): Define deforestation? Discuss its causes and effects.

Deforestation: - Definition: -

The cutting down of trees from land without proper planning is called deforestation.

Causes of deforestation: -

i. Extension of cities requires more land, thus forest is cut to build roads and houses etc. **ii.** Over population need more land for agricultural activities thus forest is cut down. **iii.** Trees are also removed to develop pastures for grazing. **iv.** Wood is used both as timber and as fuel wood. **v.** Timber mafia cut the trees for easy cash.

Effects of deforestation: -

i. Deforestation leads to soil erosion. **ii.** Destruction of wild life habitat. **iii.** **Flooding:** With rain falls soil drain off into the rivers, which causes flooding. **iv.** **Desertification: -** Formation of deserts.
v. Reduce source of rain: Deforestation decrease transpiration. This ultimately reduce source of rains.

Q (19): Write the importance of forests? Ans:

- Importance of Forests:

i. Forests are the source of timber and fuel wood.

ii. Forest are the natural factories for the production of oxygen. **iii.** Forest control flood and prevent formation of desert. **iv.** Forest provide habitat to wildlife.

v. Forest also enhances the aesthetic value of ecosystem and a site for tourist attraction.

vi. Forest keeps the air clean by extracting carbon dioxide from air. **vii.** It provide habitat for some important animals and other organisms.

Q (20): Explain the conservation issue in Pakistan.

Ans: - Pakistan is facing many problems related to conservation of natural resources. Deforestation and hunting are most common issues.

- Due to deforestation many valuable species of plants have been lost.
- Similarly, due to hunting many animals like Houbara bustard (Talor), Marcopolo sheep, ibex (Wild goat), partridge, and falcons become endangered species.
- The dynamitic explosion and electro fishing have reduced many fish species like shermahi, mahasher.
- Musk deer are killed for glands which are used for making perfumes.
- The most serious threat faced by Indus river dolphin is the release of heavily polluted water into the sea, which is causing the blindness of these dolphin.

Major Steps for conservation of biodiversity:

Following are a few examples of the steps taken in Pakistan to conserve biodiversity. **I. Conservation of biodiversity of Suleiman range:**

Suleiman range chilgoza forest is the largest chilgoza forest in the world. In 1992 the WWF-P started its conservation program.

II. Northern areas conservation project:

The northern areas of Pakistan serve as a habitat for a number of wildlife species. The survival of these species in under threat. The NACP is a project of WWF-P which is successful in implementing a ban on the hunting of these species. **III. Conservation of migratory birds in Chitral, NWFP**

Chitral lies on the migratory route of several important birds' species. The birds face enormous pressure. WWf-Pakistan initiated efforts to reduce the hunting pressure in 1992. The efforts proved successful.

IV. Conservation of ChiltanMarkhor:

Hazarganji national park is located close to Quetta and is the only remaining habitat of chiltanMarkhor in the country. WWF-Pakistan developed the management plan of the park. **V. Bear baiting in Pakistan:**

Bear baiting is an old game in the subcontinent that came with the Britishers. WWF-Pakistan has been successful in imposing a ban on this illegal practice. The government of Pakistan played an active role in putting and ends to this cruel sport.

VI. Himalayan wildlife project to check the hunting of brown bears.

VII Indus Dolphin Project to save Indus Dolphin

VIII. Protected areas management Project in Machiara in Azad Jammu Kashmir.

IX. Marine Turtle conservation Project.

X. Bane on the hunting of Markhor and Urail in Baluchistan.

XI. Himalayan Jungle Project to protect the biodiversity in Himalayan region.

Importance of biodiversity: -

- It provides us medicinal plants.
- It gives us food.
- It is a source of Recreation.

- It saves endangered species.
- It saves our land from soil erosion.

SHORT QUESTION

B. Write Short answer of the following Question?

Q1. How Deforestation lead to desertification?

Ans: Deforestation:

Deforestation is the removal of forest and trees in unwise manner is called deforestation.

Desertification:

The formation of desert is called desertification.

Formation of Desert:

Desert form after deforestation with deforestation the rain fall reduces which convert the green area of ecosystem to desert. Desertification occurs due to deforestation. Due to deforestation the rain fall reduces which convert the green area of the environment to the desert.

Q2. Why is it important for a biologist to understand biological classification?

Ans: Importance of biological classification for a biologist:

i. To know about the origin of organisms.

ii. Classification helps biologist to study organism easily.

iii. To determine similarities and difference among living organisms.

iv. It also helps biologist to give an idea about the sequence of evolution among organism.

Q3: What is the status of viruses in classification?

Ans: A virus having both living and non-living properties and are present in the borderline between living and non-living that is why there is no place for virus in five kingdom system of classification.

Difference between living and nonliving characters:

Living Characteristics:

i. They can reproduce inside the host cell(obligate parasite).

ii. They contain nucleic acid either DNA or RNA as hereditary materials.

iii. They can grow inside the host cell.

iv. They cause diseases in living organisms.

Non- Living characteristics:

i. Viruses cannot live without a host cell and can be crystallized.

ii. They can be crystallized outside the host cell. iii. They cannot Respire. iv. They cannot excrete.

Q4: How you can differentiate between kingdom Monera and Protista? Ans:

Difference between Kingdom Monera and Protista:

Properties	**Kingdom Monera**	**Kingdom Protista**
Cell type	Prokaryotic	Eukaryotic
Nuclear envelop	Absent	Present

Cell wall	Made of murein	Various type
Membrane bounded organelle	Absent	Present

Q5. List down the endangered species of Pakistan? And what are the reasons behind their population decrease?
Ans: See Q No. 17

LONG QUESTION

C: Give detailed answer of the following Question.

Qi. Differentiate between two kingdom system and five kingdom system along their advantages and disadvantages:

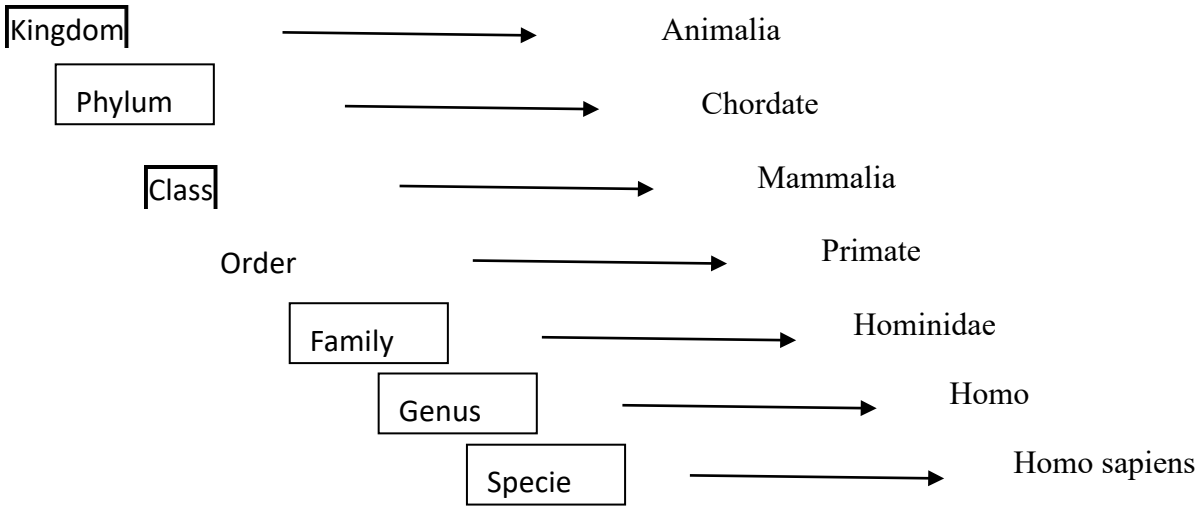
Ans: See QNo. 8

Q ii. Take an organism and assign it to different ranks according to hierarchy of taxonomy?

Ans: The group into which organism are classified are known as taxonomic categories or taxa (Kingdom " taxon") and these taxa from a ladder, called taxonomy hierarchy.

For example:

The taxonomic hierarchy of humans is shown below.



Qiii. How human activities effect the biodiversity of an area? Ans:

See Q No. 15

Qiv. Explain Binomial Nomenclature? What are its advantages?

Ans: **Terminology**:-

- Bi Means two
- Nominal means names

Nomenclature: Means naming System.

Introduction:-

It was developed by a Swedish biologist Carolus Linnaeus in 1757. According to binomial nomenclature all living organisms have a particular name consist of two words.

The first names consist of two words. The first name refers to the species. That is why this system is known as two words naming system or binomial nomenclature.

Example:-

Homo sapiens is the zoological name of man. In this name homo is the genus and sapiens is the species.

Advantages: a)

Specify:

Each organism is given a specific name. No two organisms are given similar name.

b) Universal acceptance: -

Being generally in Latin they have universally acceptance by people of all languages.

c) Generic relationship:

It indicates generic relationship and decent of individual animals and plants.

d) Easy to understand:

Binomial nomenclature is adopted by all taxonomists because it is easy to understand.

Q5. What are the reasons for the extinction of biodiversity worldwide? What measures are required to conserve the biodiversity of Pakistan? Ans: **Extinction:**

The loss of specie forever is called extinction.

Reason for extinction: i.

Over population:

Human population is increasing day by day. This cause more pressure on our natural environment. **ii Hunting:**

Human killed endangered wild animals. And gradually these animals extinct from our natural environment. **iii.Deforestation:**

The unwise cutting of trees from environment is called deforestation. **iv.**

Climate change.

Climate conditions are changing rapidly so the species which cannot adopt the new climatic condition can die. **v.Pollution:**

Pollution also causes the extinction of biodiversity.

Measures:

- Strict rules should be applied by the government to protect endangered species.
- Killing of endangered species of animals should be banned.
- The habitat should be improved.
- Wild life parks, game sanctuaries and zoo should establish. ➢ Afforestation and re-forestation are required.

CHAPTER NO 4.

Cell and Tissue

Q1: Define cell, unicellular and multicellular organisms?

Ans: Cell

The basic structural and functional unit of all living organisms is called cell

Unicellular Organisms: -

Those organisms which are made from single cell are called unicellular organisms.

Example:

Amoeba, Paramecium etc.

Multicellular organisms: -

Those organisms which are made from more than one cells are called multicellular organisms. **Example:** All plants and animals

Q2: Define tissue? Also discuss the types of tissue. (additional Question)

TISSUE: - Definition:

-

Group of cells which perform particular function is called tissue.

Types of Tissue: -

There are two types of tissue.

- ➢ Simple tissues ➢
- Compound Tissues.

Simple Tissues: -

Those tissues which are made from the same kind of cell are called simple tissues. They are found both in plants and animals.

Compound Tissues: -

Those tissues which are made from different kind of cells are called compound tissues. They are present in plant but absent in animals.

Q3: Define microscopy? Explain Microscope and their types?

Ans: Microscopy:

The use of microscope to observe very minute living organisms is known as microscopy.

Microscope: -

It is an instrument which is used for the observation of those things which cannot be seen with naked eyes.

Discovery: -

Zacharias Janssen and his son Hans Janssen were two eye glass makers in Holland. They discovered first microscope in 1595. It was simply a tube with lenses at each end and its magnification from 3x to 9x.

Anton van leeuwenhoek (1632-1723):

Anton van leeuwenhoek was Dutch scientist made much better microscope and observed small organism under it. The magnification power of leeuwenhoek's microscope was more than 250x. He is considered to be the first microscopist.

Q4: Define magnification and resolution of microscope?

Ans: Magnification: -

The capacity of microscope to enlarge the apparent size of a small object is called magnification. The magnification power of electron a light microscope is 1500x.

Resolution: -

The capacity of microscope to differentiate between two close objects is called Resolution. The human eye can differentiate between two points, which are at least o.1 mm apart. This is known as resolution of human eye. The resolution power of light microscope is o.2µm.

Q5: Write the characteristic features of light and electron microscope?

Ans: Light microscope:

Definition:

Those microscopes which uses light to make the image of an object is called light microscope.

Light pathway:

Light passes through the simple and then through two glass lenses.

Image formation:

Lens produces an enlarge image of the sample and the second lens magnifies the image more. After passing through the object and lenses, the light is projected into the viewers eye when an enlarge and clear image is formed.

Magnification:

The magnification of a light microscope is 1500x. It can magnify objects only about 1500 times.

Resolution:

The resolution of light microscope is 0.2µm.

Electron microscope:

Definition:

It is the most advance form of microscope which use beam of electron to make the image of an object.

Image formation:

In electron microscope, the object and the lenses are placed in a vacuum chamber and a beam of electron is passed through object. Electrons pass through or are reflected from the object and make the image.

Magnetic lenses;

Magnetic lenses focus the electron beam on a screen and make much enlarge image.

Resolution:

Resolution of electron microscope is 0.2mm. **Types of Electron Microscope: -**

There are two types of electron microscope.

Scanning electron microscope (SEM): -

- It uses an electron beam to scan the surface that has been coated with metal.
- The SEM does not have great magnifying power. **Transmission Electron Microscope (TEM): -**
- It is used for the study of internal structure of cell or any other object. ➢ It can magnify objects about 250,000 times.

Q6: Differentiate between Light and Electron microscope? Ans:

Comparison between light and electron microscope:

	Light Microscope	**Electron Microscope**
Radiation source	Light	Beams of Electron
Lenses	Optical	Magnetic

Magnification	10,000 times greater than the naked eye	100 times greater than light microscope
Resolution	500 times of the naked eye	400 times of the light microscope
Images	2 D images	TEM show 2D While SEM Shows 3D Images
Wave length	400 – 700`	0.005nm

Q7: Write the brief history of cell theory?

Ans: History of Cell Theory: - Robert Hook:-

Robert Hook was an English scientist who discovered cell in 1665. He observed piece of cork under his self-made microscope. He observed small chambers like honey comb structures and he named it cell.

Anton van Leeuwen Hook:-

Leeuwen Hook was a Dutch scientist. He studied a drop or pond water under his own made microscope. The magnification power of his microscope was 300x. He noticed tiny creature swimming in the drop of pond water. Leeuwen Hook was the first man to observe single celled organisms called unicellular organisms.

Jean Baptist de-Lamarck:

In 1809, jean Baptist de-Lamarck proposed that "Nobody can have life if its constituent parts are not formed by cellular tissues."

Dolland:-

Dolland in 1827 improved the quality of lenses. After that all the scientist were interested in microscopy.

Robert Brown:-

In 1831, a British botanist Robert Brown discovered the nucleus in the plant cell.

Mathias Schleiden:-

In 1839 a German Botanist Matthias schleiden studied plant tissues and made the first statement of the cell theory. He stated that "all plants are made up of cells"

Theodor Schwann: -

In 1839 a German Zoologist Schwann found that all the animals are made from cells.

Thus, schleiden and Schwann proposed cell theory in its Italian from i.e., "all living things are composed of living Cells".

EvenglodaPurkyne: -

Purkyne was an English scientist. In 1840 he proposed that all the cellular contents are living materials and gave them the name of "Protoplasm". **Rudolf Vivchow;-**

In 1855, Rudolf Virchow, German physician gave his hypothesis that every cell comes from a pre-existing cell. ("Omnis Cellula a celula"). **Louis Pasteur:-**

In 1862, a French scientist Louis Pasteur experimentally proved the hypothesis of Rudolf Virchow. He experimented on bacteria and found that bacteria are produced from pre-existing bacteria.

Q8: Write the main points of cell theory?

Ans: Cell Theory:-

Cell theory was first proposed by two German scientists, Botanist Matthias Schleiden and Zoologist Theodor Schwan.

Main Points:-

- All living organisms are made from one or more cells.
- Cell is the basic structural and functional unit of all living organism. ➢ New cells arise from pre-existing cells by cells division.

Q9: What do you meant by acellular or sub-cellular particles?

Ans: According to first principle of the cell theory all organisms are composed of one or more cells. Discovery of virus prions and viroid claims that the statement is not universal. They are not composed of cells rather they are sub-cellular or acellular particles. As they show some characteristics of living organisms i.e., they can increase in number and can transmit their characteristics to the next generation.

Q10: Describe the structure of Cell Wall?

Ans: Structure of Eukaryotic Cell:-

Cell Wall:-

It is nonliving structure present in bacteria, plants, fungi and some protists.

Location:-

Cell Wall is located outside the cell membrane.

Chemical Composition:-

The cell wall of plant cell is made from cellulose while the cell wall of Fungi and prokaryotes are made from chitin and murein respectively.

Structural of Cell Wall:-

Cell Wall is mainly composed of three main layers. **i).**

Primary Wall:-

It is the outer layer of cell wall which is composed of cellulose. Cellulose molecules are arranged in crisscross manner. **ii. Secondary wall:-**

It is the second layer of cell wall which lies inner to the primary wall. It is comparatively thick and rigid than the primary wall. **iii. Middle Lamella:-**

It is the inner layer between primary walls of two adjacent cells.

Function of Cell Wall:-

- **Protection:** It protects the cellular contents from the outer environment. ➢ **Support:** It gives support to the plant cell.
- **Shape:** It gives proper shape to the cell. ➢ **Rigidity:** It provides rigidity to the cell.

Q 11: Explain the structure and function of cell membrane?

Ans: Cell Membrane:-

All prokaryotic and eukaryotic cells have a thin and elastic cell membrane covering the cytoplasm. It is the outermost layer of the animal cell. In the cells of bacteria plants fungi and some protists, cell membrane lies beneath cell wall.

Chemical Composition:-

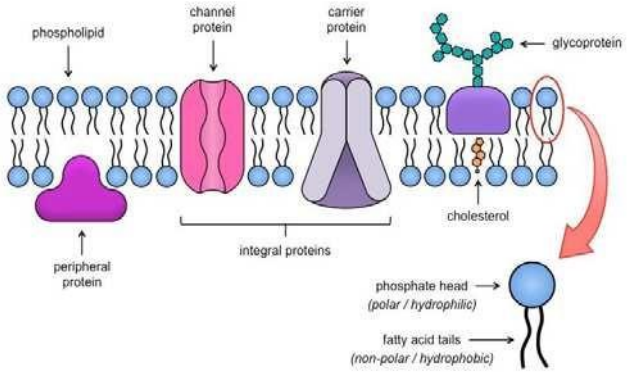
Chemically cell walls are composed of 20-40% lipids and 60-80% proteins and also contain some carbohydrates.

Structure of Cell Membrane:-

Many scientists presented different models for the structure of cell membrane. Among them the most acceptable model is Fluid mosaic model.

Fluid Mosaic Model:-

In 1972 singer and Nicolson presented a model about the structure of cell membrane which is known as fluid mosaic model. According to this model, lipids bilayer is a sea and the protein are floating over it while some stay embedded in the bilayer. Carbohydrates molecules are joined with proteins or with lipids.



Cell membrane as semi permeable membrane:-

Cell membrane is a semi permeable membrane because it controls the inflow and outflow of material of cell. It is thin delicate and elastic. It controls the movement of the molecule passing through it. It allow only the passage of water and other small molecules such as gases while other substances such as glucose, amino acids etc can slowly diffuse through it.

Function:-

- **Protection:** It protects the inner parts of cell.
- **Shape:** It gives proper shape to the cell.
- **Regulation:** It regulates the inflow and outflow of substances.
- **Binding site:** It provides binding sites for ATP and other biological molecule.

Q 12: Define cytoplasm? Describe the structure of cytoplasm. Ans:

Cytoplasm:-

The portion of the cell which lies between the nuclear membrane and cell membrane is called cytoplasm. It contains a variety of cell organelles and other substances.

Characteristics:

It is translucent, living and viscous substances.

Main Parts:-

It consists of two main parts.

Soluble Part:-

Soluble Parts contain about 70% Water and 30% organic and inorganic substances.

Insoluble Part:-

Cell organelles are the insoluble part of cytoplasm.

Portion:

Cytoplasm is divided into two portions.

i) **Ectoplasm:** The outer clear portion is called ectoplasm.

ii) **Endoplasm:** The inner granular portion is called endoplasm.

Function:

- The cytoplasm of the cell provides space for the proper functioning of the organelles.

- It also act as the site for various metabolic reactions for example Glycolysis (breakdown of glucose during cellular respiration) Cytoplasm store useful substance like protein, lipid, vitamin, carbohydrates.

Q13: Describe the structure and function of Endoplasmic Reticulum?

Ans: Endoplasmic Reticulum:-

Terminology:-

- Endo means internal ➢ Plasm means cytoplasm
- Reticulum mean network.

Structure:

It is a network of interconnected channels present throughout cytoplasm.

These membranes enclosed flattened sacs called Cisternae.

Types of Endoplasmic Reticulum:- There are two type of endoplasmic reticulum. **i.**

Rough endoplasmic reticulum:-

The endoplasmic reticulum which has small granules called Ribosome present on its surface is called rough endoplasmic reticulum. It is attached with nuclear membrane.

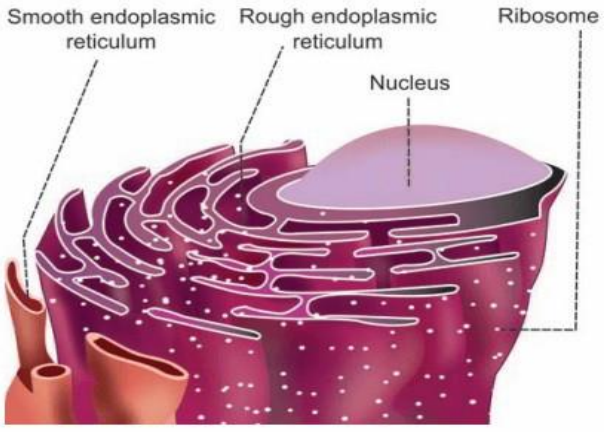
Function:-

- Rough endoplasmic reticulum is involved in protein synthesis.
- Transport of materials from nuclear membrane to cytoplasm. ➢ They give support to the cell. **ii. Smooth Endoplasmic Reticulum:-**

The endoplasmic reticulum which has no ribosome's present on its surface is called smooth endoplasmic reticulum. It is attached with cell membrane.

Function:-

- It plays an important role in the formation of lipids.
- They transfer materials from one part of cytoplasm to another.
- Detoxification of toxic materials.
- They give support to the cell.



Q14: Describe the structure and function of mitochondria?

Ans: Mitochondria:-

Mitochondria are the important organelle of a eukaryotic cell but absent in prokaryotes.

Shape:-

Mitochondria are oval, rod shaped or filamentous shape bodies.

Discovery:-

They were discovered by Granules in 1850 in muscle cell by electron microscope.

Structure:-
Mitochondrion is bounded by double membrane. The outer membrane is smooth and the inner membrane is inwardly folded these folds are called cristae. Cristae increase the surface area of respiratory process. **Power House:-**
Mitochondria are energy producing organelles therefore they are called powerhouse of the cell.
Replication:-
Mitochondria are the self-replicating organelle.
Function:-

- Mitochondria play a role in cellular respiration. They produce energy rich ATP molecules.
- Most of the enzymatic activities of the cell are carried out by mitochondria.

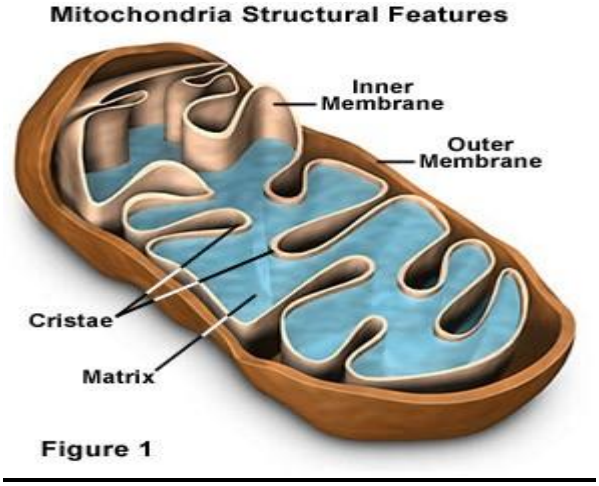


Figure 1

Q15: Explain the structure and function of Golgi Bodies?
Ans: Golgi Bodies:-
Golgi Bodies were first discovered by an Italian Scientist Camillo Golgi in 1898.
Shape:-
Golgi bodies are in the form of granules, rods, threads or canals.
Structure:-
Golgi bodies consist of stacks of flattened sacs made of membrane which are arranged parallel to each other called cisternae.
Other Name:-
They are also known as Golgi apparatus. In plants it is generally known by the name of Dictyosomes.
Function:-

- Golgi bodies store the secretory product.
- Golgi bodies modify and pack the secretory products at their margins into small rounded sacs called Golgi vesicles or lysosomes.
- They also synthesize complex carbohydrates from simple sugar.

Q16: Describe the structure and function of Ribosome and Plastid? Ans:
i) Ribosomes:-
Ribosomes are the only organelles found in all prokaryotic and eukaryotic cells.
Position:-
They are either freely dispersed in cytoplasm or attached with ER(endoplasmic reticulum).
Discovery:-
Ribosomes were discovered by Palade in 1955.

Structure:-

Ribosomes have two subunits.

- Large subunit.
- Small subunit.

Small and large subunit combines to form ribosome. **Formation:-**

They are produced in nucleolus.

Composition:

A ribosomes is made of almost equal amount of protein and ribosomal RNA (rRNA).

Size:-

Eukaryotic Ribosomes:

- Ribosome present in eukaryotes is of 80S.

Prokaryotic Ribosome:

- Ribosome of prokaryotic cell is of 70s, **Group of Ribosome:**

Group of ribosome is called polysomes.

Function:

Ribosomes are the site of protein synthesis.

ii.Plastid: Definition;

Plastids are also membrane bounded organelles that only occur in plant and photosynthetic protest (algae)

Types of Plastids:-

There are three types of Plastids. **i).**

Chloroplast:-

It is the most important and abundant type of plastids. It is bounded by double membrane. The outer membrane is smooth while inner one give rise to membranous sac called thylakoids. The stack of thylakoids is known as granum (pl. grana).

Position:-

These are present in green parts of plants particularly in leaves.

Colour:-

Chloroplast are green in colour due to green pigment called chlorophyll.

Structure of chloroplast:-

Chloroplast is bounded by double membranes. A smooth outer membrane and an inner folded membrane which is modified into stack / pile of coins. **Granum:-**

Each coin of the granum is called thylakoid. They combine to form granum.

Intergrana:-

Granum is attached with each other by intergrana. **Stroma;-**

The semi fluid and gelatinous matrix present inside the chloroplast is called stroma.

Function;-

The process of photosynthesis occurs in chloroplast.

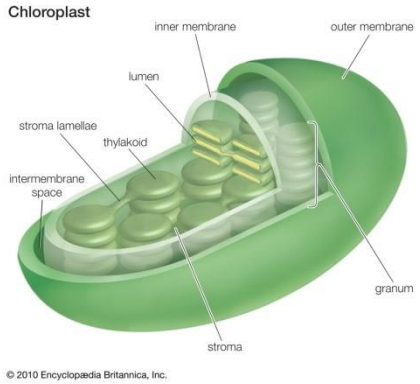
Photosynthesis complete in two steps, light reaction and dark reaction. **a.**

Light Reaction;-

Light reaction of photosynthesis occurs in grana. **b.**

Dark Reaction:-

Dark Reaction of photosynthesis occurs in stroma.



ii. Chromoplast:-

Location:-

It is present in the petal of flowers and in the skin of ripened fruits.

Colour:-

In plants colours other than green are due to Chromoplasts.

Function:-

Its bright colour attracts insects for pollination. **iii.**

Leucoplast:

Leucoplast is colorless plastids. They are present in underground parts of the plants particularly in roots.

Position:-

They are present in underground part of the plant called roots.

Colour: -

Leucoplast is colourless.

Function:-

They store food materials such as starch, protein and lipid.

Q17: Write short note on cytoskeleton?

Ans: Cytoskeleton:

Meaning:

Skeleton of cytoplasm.

Cytoskeleton is an important complex and dynamic cell component. It is invisible under light microscope.

Structure:

Two important types of filaments make up the cytoskeletons are,

i. Microtubules ii. Microfilaments i. Microtubules: -

Microtubules are made up of a protein called actin. These microfilaments are approximately onethird of the diameter of a microtubule.

Function: -

- Microtubules are also the major component of cilia and flagella.
- Microfilaments are often used by cells to change their shapes and to hold the structure.
- It maintains the cell's shape, anchors organelles in place and moves parts of the cell in processes of growth and motility.

Q18: Write short note on centrioles and Vacuole? i.

Centriole: -

These are the cell organelles that are present in animals' cell and in unicellular organism. It is also present in young plants and animals. They are two in number and are collectively called centrosomes. **Location: -**

They are small rounded bodies present near the nucleus.

Structure: -

These are hollow cylindrical structures called microtubule. Each centriole contains nine triplets of microtubules (27) microtubules). Each microtubule is composed of tubulin proteins. **Diameter: -**

Each microtubule is 0.2 micrometre in diameter.

Triplet: -

A group of three microtubules is called triplet. There are nine triplets in a centriole. Each microtubule is composed of tubulin proteins. Tubulin protein has three-dimensional shape.

Function: - Animal Cell: -

In animal cell they help in the formation of spindle fibers which help in the separation and movement of chromosomes during cell division.

Unicellular organisms: -

In some unicellular organisms it helps in the formation of cilia and flagella which are the locomotory organs of some unicellular organisms. **ii. Vacuole: -**

It is a single membrane bounded organelle present in the cytoplasm of both plants and animal cells.

Tonoplast: -

Vacuole is bounded by single membrane called tonoplast. In plant cell there is a single large vacuole present in the center while in animal cell there are many small vacuoles. In unicellular organisms there are two vacuoles.

- **Food vacuole:** Digestion of food occurs in food vacuole.
- **Contractile vacuole:** Excretion (removal of metabolic waste and toxic materials).

Function: -

- A plant vacuole store important material like water, amino acids, sugar and some minerals.
- Many cells take in materials from outside in the form of food and then digest the materials with the help of lysosomes.
- Some unicellular organisms use contractile vacuole for the elimination of wastes from their body.

Q19: Describe the formation and function of lysosomes? Ans:

Lysosomes:

In the mid of twenty century, the Belgian scientists Christian Rene de Duve discovered lysosomes. De Duve in 1947 won the Nobel prize for physiology and medicine.

Structure: -

These are single membrane bound organelles. Lysosomes contain strong digestive enzymes and work for the breakdown of food and waste materials within the cell.

Function:

A lysosomes fuses with the vacuole that contains the targeted materials and its enzymes break down the materials. It is also termed as suicide bags of cell because it helps during cell death (apoptosis).

Q20: Explain the structure of nucleus? Ans:

Nucleus: -

It is the most important part of cell. It is also called brain of the cell because it controls all the cellular activities. **Discovery: -**

Shape: -

Nucleus is spherical in shape.

Location; -

- In animals cell nucleus is present in the center.
- In plant cells, it is pushed to the side due to the presence of large central vacuole.

Structure of Nucleus: -

Following are the main parts of the nucleus. **i.**

Nuclear Membrane: -

Nucleus is bounded by a double membrane called nuclear envelope. It is present in eukaryotes but absent in prokaryotes.

Porous: -

Small pores are present on the surface of the nucleus. The pores allow the exchange of materials between the nucleus and cytoplasm.

ii. Nucleoplasm: -

Inside the nucleus there is a granular matrix called nucleoplasm. It contains chromosomes and round shape structures called nucleolus. (Plural-nucleoli).

iii. Nucleoli: -

These are one or two rounded structures present in the nucleoplasm.

Function of Nucleoli: -

It is responsible for the formation of ribosomal RNA. Ribosomal RNA plays an important role in the formation protein synthesis.

iv. Chromosomes: -

Chromosomes are in the form of a network of fine threads present in Nucleoplasm.

Terminology: -

The word chromosomes have derived from two words.

- **Chroma** mean colour.
- **Soma** mean bodies. **Chemical Composition: -**

Chromosomes are made of DNA and proteins.

Structure: -

Each chromosome is composed of two main parts.

- Two chromatids.
- One centromere.

Function of chromosomes; -

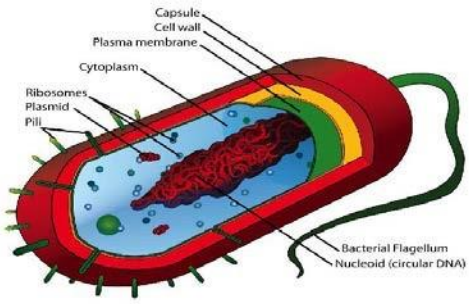
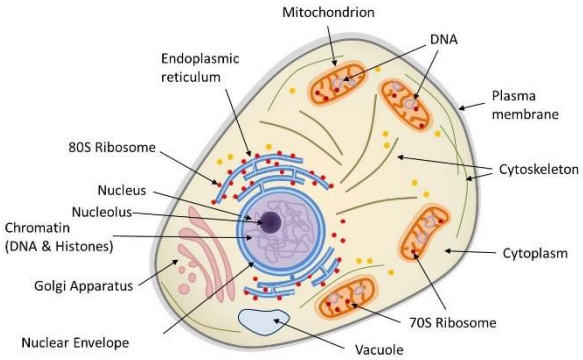
It is responsible for the transmission of hereditary characteristics from parents to off springs.

Number of Chromosomes; -

Members of same species having the same numbers of chromosomes. Chromosomes in different species are given below.

Specie	Chromosomes	Pairs
Human	46	23
Radish	18	9
Onion	16	8

Q21: Difference between prokaryotic and eukaryotic cell?

S.No	Prokaryotic Cell	Eukaryotic Cell
1	They have no true nucleus.	They have true nucleus.
2	Due to the absence of nuclear membrane chromosomes are dispersed in cytoplasm	Due to the presence of nuclear membrane chromosomes are present in the nucleus.
3	Ribosome is small in size (70s)	Ribosome is large in size (80s)
4	Cells are small in size 0.5nm in diameter.	Cells are large in size from 10nm to 100nm in diameter.
5	The cell wall is made of murein.	The cell wall of plants is made of cellulose while in fungi is made of chitin.
6	**Example:** Bacteria and cyanobacteria (Blue green algae) 	**Example:** Plants, Animal and Fungi. 

Q 22: **Why cells are specific in their function? Ans:**

Cell specificity: -

The basic structure and functional unit of all living organisms is called cell. Every living organism is composed of different types of cell. Each type of the cell performs a specific function. **Examples: -**

Plants: -

- Xylem cells are responsible for the transport of water and dissolved minerals from roots to leaves.
- Phloem cells are responsible for the transport of food from leaves to all parts of plant body.
- Root hair cells are responsible for the absorption of water and dissolved minerals. ➢ Cells involve in photosynthesis have chloroplast. **Animals: -**

- In animals nerve cells are responsible for the transmission of impulses.
- In muscular cells are responsible for movement.

- Red blood cells carry oxygen and white blood cells kill foreign agents.

Relation between cell function and cell structure:

Cell of one type may differ from those of other types in following respects.

Size and Shape	• Nerve Cells are long for the transmission of nerve impulse. • Xylem cells are tube like and have thick walls for conduction of water and support. • Red blood cells are round to accommodate globular haemoglobin.
Surface area to volume ration	• Root hair cells have large surface area for the maximum absorption of water and salts.
Presence or absence of organelles	• Cell involved in making secretion have more complex ER and Golgi apparatus. • Cells involved in photosynthesis have chloroplasts.

Q 23: Cell as an open system? Justify the statement.

Ans: A cell works as an open system. That is

- It takes in substances needed for its metabolic activities through its cell membrane.
- Then it performs the metabolic processes assigned to it.
- Products and by products are formed in metabolism.
- Cell either utilizes the products or transports them to other cells.
- The by products are either stored or are excreted out of the cell.

Q24: Explain how surface area to volume ratio limits cell size.

Ans: Cell size and surface are to volume ratio:

Cells are varying greatly in size. The smallest cells are bacteria, with diameter between 0.1 m to 1.0 m. The bulkiest cells are bird eggs, and the longest cells are muscle and nerve cells. Most cells are small in size.

- Large cells have less surface area in relation to their volume while small cells of the same shape have more surface area.

In the figure below show 1 large cell and 27 small cells. In both cases the total volume is the same:

Volume: 30µm x 30µm x 30µm = 27,000µm^3

- In contrast to total volume, the total surface areas are very different. Because the cubical shape has 6 side, its surface area is 6 times the area of 1 side.

The total surface areas of the cubes are as follows.

Surface area of 1 large cube = 6 x (30µm x 30µm) = 5400µm^3

Surface area of 1 small cube = 6 x (10µm x 10µm) = 600µm^3

Surface area of 27 small cubes = 27 x 600µm^2 = 16,200µm^2

This relationship between cell size and surface area to volume ratio works to limits cell size. As the size of a cell increases cell volume increases more rapidly than its surface area.

The need of nutrients and rate of waste production are directly proportional to cell volume. The cell takes up nutrients and excretes wastes through its surface cells membrane. So, a large volume demands large surface area.

Hence it concluded that the membranes of small cells can serve their small volumes more easily than the membrane of large cell.

Q25: Explain the phenomenon involved in the passage of materials across the cell membrane?

Ans: Cell membrane is called differentially or semi permeable membrane as it controls the inflow and outflow of materials to cells. Cell membrane maintains equilibrium inside as well as outside the cell. The control of the passage of molecules into and out of cells is made possible through following phenomena. **Types: -**

There are two types of movement.

Active Transport: -

Definition: -

The movement of molecules across cell membrane from lower concentration region to higher concentration with the expenditure of metabolic energy is called active transport.

For the active transport of substances carrier proteins present in cell membrane use energy and move them against concentration gradients. Na^+ /K^+ are actively transported across the requirement of the cell/body. **Example: -**

Nerve impulse is carried when Na^+ is actively transported across the membrane from nerve cell to outside.

Passive Transport: -

Definition: -

The movement of molecules from higher concentration region to lower concentration region without the expenditure of energy is called passive transport.

Example: -

i. Diffusion ii. Facilitate diffusion iii. Osmosis.

1. Diffusion: -

Definition: -

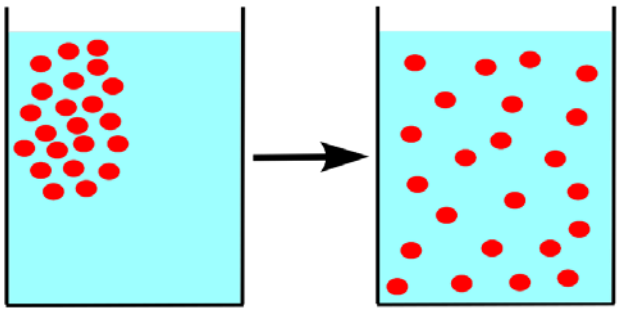
The movement of molecules from higher concentration region to lower concentration region without the expenditure of energy is called diffusion.

It is a type of passive transport. **Explanation: -**

Only small molecules can diffuse through cell membrane e.g. water, carbon dioxide, oxygen and some other simple molecules. Diffusion is slow process yet it is efficient and rapid enough to fulfil the requirement of the cells.

Important: -

- Substances such as glucose, O_2 and CO_2 can easily diffuse through the membrane. Glucose is present in higher concentration after the food is digested in small intestine. Therefore, glucose is transported to villi from the inner space of small intestine through diffusion to be stored in the form of glycogen.
- Carbon dioxide and oxygen are among the few simple molecules that can cross the cell membrane by diffusion. Gases exchange in gills and lungs operates by this process.

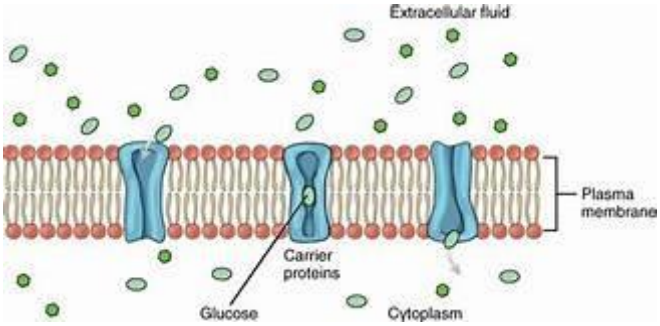


2. Facilitated

Diffusion: - Definition:

The movement of molecules from high to low concentration with the help of transport proteins present in cell membrane.

Many molecules do not diffuse freely across cell membrane because of their size or charge. Such molecules are taken into or out of the cells with facilitated diffusion is higher than simple diffusion. Facilitated diffusion is also a type of passive transport because there is no expenditure of energy in this process.



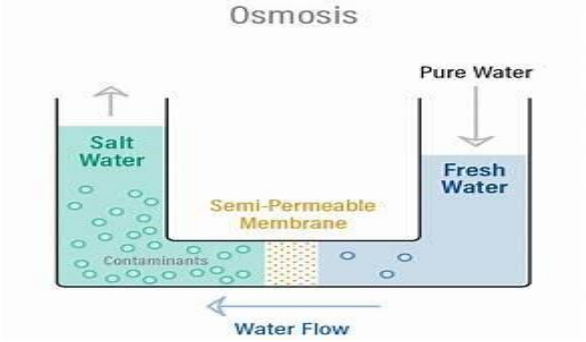
3. Osmosis: -

Definition: -

The movement of solvent molecules from higher concentration to lower concentration region through semi permeable membrane is called osmosis.

Example of Osmosis: -

Plant cell absorb water and store it in vacuole by osmosis.



Q26: Define turgidity and plasmolysis?

Ans: 1. Turgidity:

Definition:

When a cell absorbs water and become swell is called turgid cell and this phenomenon is called turgidity.

Mechanism:

When we place the plant cell in pure water or in dilute solution. The plant absorbs water by osmosis and stores it in vacuole. Due to this storing of water the plant cell will swell.

Turgor Pressure: -

The internal pressure exerted on the cell wall is called turgor pressure.

Importance: -

i. It keeps the herbaceous plants erect.

i.e. helps in opening and closing of stomata.

iii. Some flower open during day time and close at night time this is due to change in turgor. **iv.** It gives proper shape to the cell.
v. The upward movement of water and dissolved minerals is due to turgor.

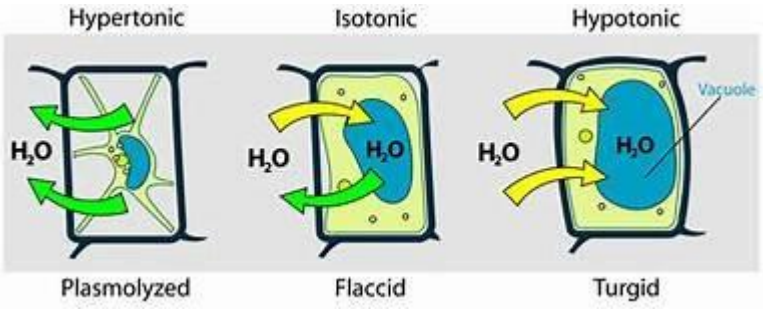
2. Plasmolysis: - Definition:

-

The condition in which plant cell loose water and become shrink is called plasmolysis. And the cell is also called plasmolysis cell.

Mechanism: -

When a plant cell is placed in a solution having lower water potential than the cell contents. The water leaves the cell by osmosis. In this way the cell become shrink. This phenomenon is called plasmolysis and the cell is also called plasmolysis cell.



Q27: Discuss endocytosis and exocytosis?

Ans: 1. Endocytosis: - Definition:

-

The movement of materials from outside environment to inside the cell is called endocytosis. Endocytosis occurs in following steps.

i. A portion of cell membrane invaginates (depressed inward) ii. The material from outside is taken inside the invagination. iii. The open end of the invagination seal and form a small vesicle. iv. The vesicle detaches from the cell membrane and moves into the cytoplasm. **Forms: -**

There are two forms of endocytosis.

Phagocytosis: -

The endocytosis of solid objects is called phagocytosis. It is also called eating of cell.

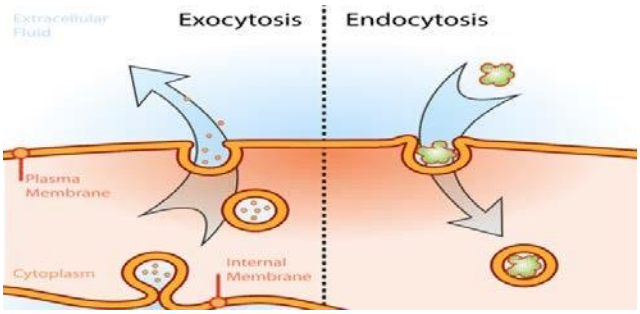
Pinocytosis: -

The endocytosis of liquid substances is called Pinocytosis. It is called dinking of a cell.

2. Exocytosis: -

The movement of waste materials from inside of the cell to the outside environment is called Exocytosis. Exocytosis occurs in following steps.

i. The bulky materials are packed inside a membrane and a vesicle is formed.
ii. The vesicle moves to the cell membrane.
iv. The vesicle fuses with the membrane and releases its contents into the extracellular environment.



This process adds new membrane which replaces the part of cell membrane lost during endocytosis.

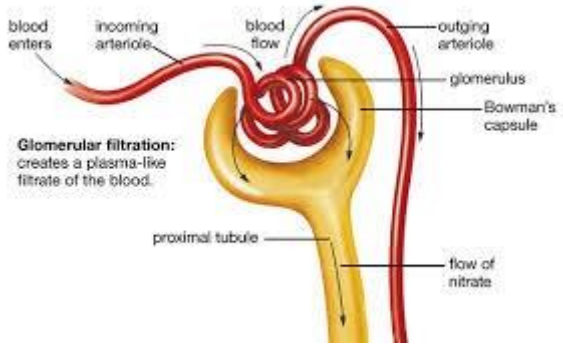
Q28: What is Filtration? Justify the statement.

Ans: Filtration: -

Filtration is a process by which small molecules are forced to move across semi-permeable membrane with the aid of hydrostatic (water) pressure of blood pressure.

In filtration the pressure cannot force large molecules, such as proteins to pass through membranes pores. **Example: -**

In our body filtration occurs in the kidney and helps us filter out harmful substances.



Q29: Define tissue? Discuss various types of plant tissues? Ans:

Tissue: -

A group of cells which perform a particular function is called tissue.

Types of Plant Tissues: - There are two types of plant tissue. **i.**

Simple Tissue.

ii. Compound Tissue.

i. Simple Tissues: -

Definition: -

The tissue which is made from single type of cells called simple tissue.

Types of simple tissue: -

There are two types of simple tissue. A.

Meristematic tissues.

B. Permanent tissues.

A. Meristematic tissue (Embryonic tissues): -

Definition: -

These tissues are made up of cells which have the ability to divide.

Location: -

They are present on the apical point and lateral side of roots, stem and branches of a plant.

Properties: -

i. The cells of meristematic tissue are closely packed i.e. they have no intercellular spaces.

ii. They have no small vacuoles. **iii.** Nucleus is present in the center of the cell. **iv.** They have a delicate and thin cell wall. **v.** They have power of cell division.

There are two main types of meristematic tissues recognized in plants.

1. Apical meristem:

These are located at the apices or tips of roots and shoots. When they divide, they cause increase in the length of plant. Such a grown is called primary growth.

2. lateral meristems: -

These are located on the lateral sides of roots and shoot. By divide they result in the increase of thickness of root and shoot such a growth is called secondary growth.

Lateral meristems are further of two types. **a.**

Vascular cambium:

Vascular cambium is present between the xylem and phloem tissues. Its cells divide and form new xylem tissues toward the center and new phloem tissue towards the outside. **b. Cork cambium:**

Cork cambium is present in the outer lateral sides and its cells are responsible for making the characteristic corky layer. **B. Permanent tissue: -**

Permanent tissue originates from the meristematic tissue. These tissues are composed of cells which do not have the ability to divide.

Types of permanent tissue: -

There are three types of permanent tissue.

1. Epidermal tissue.
2. Ground tissue.
3. Supporting tissue.

1. Epidermal Tissue: -

Terminology: -

The word epidermal is derived from two Greek words.

• Epi means above •

Dermis means skin.

Location: -

These tissues are present as outermost protective layer of roots, stems, branches and leaves.

Characteristics: -

i. Cell of the epidermal tissue are flattened and irregular in shape.

ii. They are thick walled and closely packed with no intercellular spaces. iii. In stem, the walls of these are covered with waxy materials which prevent loss of water. iv. In leaves, the epidermal tissue has small ground opening called stomata for gaseous exchange. **Function: -**

Leaves: -

In leaves the epidermal tissues have small pores called stomata for gaseous exchange and for transpiration. **Stem: -**

In stem the epidermal tissues have root hairs which are responsible for absorption of water. **Root: -**

In roots the epidermal tissues have root hairs which are responsible for absorption of water.

2. Ground tissues: -

Location: -

They are present in all parts of plant except epidermal and vascular tissues. **Composition: -**

Ground tissues are composed of thin walled cells called parenchyma cells.

Properties of Parenchyma cell: -

i. These are thin walled living cells. ii. They are oval or polygonal in shape. iii. They have a large vacuole. Nucleus is present in peripheral position due presence of large vacuole.

v. In leaves the ground tissue contains chlorophyll and is called mesophyll tissues. It prepares food.

Function: -

Parenchyma cells store food.

3. Supporting tissues: -

They give support and flexibility to the plant body. They are of two types.

a. Collenchyma tissues
b. Sclerenchyma tissues

a. Collenchyma tissues (Kolla-glue)

They are flexible, living cells, elongated and polygonal with tapering end.

Location: -

They are found in young stem, midrib of leaves, petals of flower and in herbaceous plants stem.

Function:

They provide strength to different parts of the plant.

b. Sclerenchyma tissues (Greek, Scleros –hard): -

They are thick walled dead cells. Their cell wall has lignin which is the main chemical component of wood.

Function: -

They give support to woody plants.

2. Compound Tissue: -

The tissue made from different type of cells performing a common function called compound tissues.

Compound tissues in plants are **xylem** and **phloem. i.**

Xylem tissue: -

Xylem tissue is composed of:

- Vessels.
- Tracheid.

a.Vessels:-

i. Vessel cells are short, wide and have thick secondary walls.
ii. These cells are dead, hollow and joins together to form long tubes. **b.**

Tracheid: -

They are spindle shape and closed at both ends. They overlap with each other with pair of pits present. The pits allow water to pass from cell to cell.

Function of Xylem: -

Xylem transport water and dissolved mineral salts from roots to upper parts of plants. These tissues also give support to plant body.

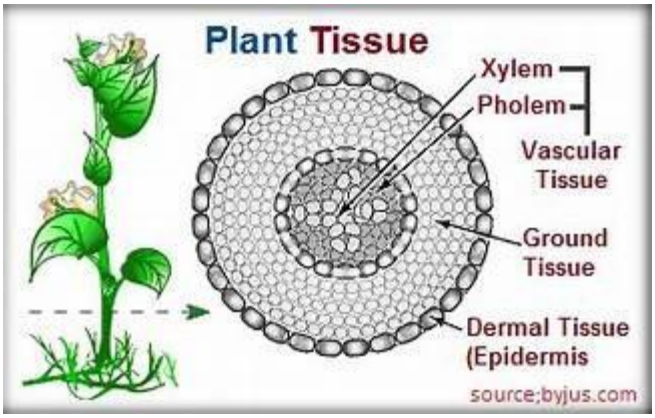
Phloem: -

Phloem is consisting of:

a. Sieve tube cells
b. Companion cells

a. Sieve tube cells: -

They are tube like structures opened at both ends. They have small pores at each end called sieve plates which join one sieve tube cell with another. **Function: -**
They transport prepared food. **b.Companion cells:-**
The sieve tube cells are accompanied by nucleated cells called companion cells.
Function:-
They control the movement of food materials in sieve tube cells.
Function of Phloem:-
Phloem transport organic food from leaves to all other parts of the plant body.



Q30: Discuss different types of animal tissues?
Ans: Animal Tissue:-
Animals tissues are classified according to their structure and function into major four types.
1.Epithelial tissue:-
Epithelial tissue are made from epithelium cells they form the outermost layer of skin.
Characteristics:
The cells in this type of tissue are very closely packed together and joined with little space with them.
Function:-
They help to protect organisms from microorganism, injury and fluid loss.

These tissues are commonly classified on the basis of the shape of the cells as well as the number of cell layers. Some types include.
i. **Simple squamous epithelium:-**
A single layer of tightly packed, flattened cells. e.g. in lining of air sacs of lungs, heart and blood vessels etc.
ii. Simple cuboidal epithelium:-
It consists of single layer of tightly packed, cube-shaped cells. e.g., found in kidney tubules and small glands. **iii. Simple columnar epithelium**
Consist of single layer of elongated cells. e.g. in lining of digestive tract and gallbladder etc.
iv Ciliated columnar epithelium
A tuft of cilia is present at the top of each columnar cell. e.g. in lining of trachea and bronchi. **v. Stratified squamous epithelium**
Consist of many layers of flattened cells. e.g. inner lining of oesophagus and at the surface of skin.
2. Connective tissue:

As the name implies, connective tissue serves "connecting" function. It supports and binds other tissue. Its cells are scattered throughout an extracellular matrix. **Types of connective tissues: i. Loose connective tissue:**

- Most common type, matrix contains loosely arranged collagen ➢ (a protein) fiber.
- Widely distributed under epithelial tissues ➢ It holds organs at their specific place.

ii. Fibrous connective tissue:

- Matrix contains tightly packed collagen fibers.
- Found in tendons, which attach muscles and bones.
- In ligaments, which join two bones

iii. Adipose tissue:

- Swollen cells due to the presence of larger number of fat droplets.
- Found around kidneys, under skin, in abdomen etc.
- Provides energy when fat is oxidized insulator against heat loss protects and supports organ.

iv. Cartilage:

- Matrix contains bundles of collagen fibers embedded in a rubbery substance.
- Provide support while allowing flexibility.
- Found around the ends of bones in external ear, in nose, trachea in discs between vertebras, as skeleton in many fishes.

v. Bone:

- Matrix contains collagen fibers embedded in calcium salts.
- Supports, protect, provide lever system for movement for movement, store calcium and forms blood cells. ➢ Found in skeleton.

vi. Blood:

➢ Matrix is not solid but in the form of fluid, red and white blood cells are suspended in plasma. ➢ Transport substance from one part of the body to the other and responsible for immunity. ➢ Found in blood vessel.

3. Muscular tissue: -

Muscle tissue consists of bundles of long cells called muscle fibers. It is the most abundant tissue in a typical animal. The cells of this tissue have ability to contract and relax.

Types:

There are three types of muscle in vertebrates.
i. Skeleton muscle. ii. Smooth muscle. iii.
Cardiac muscle.

i. Skeleton muscle:

The characteristics of skeletal muscles are

- Skeletal muscles are attached to our bones and cause movement in them. i.e. movement in them i.e. Movement of arms and legs etc.
- These are striated or stripped muscles because they have alternate light and dark bands.
- They are also called voluntary muscle because their movement is under our control. ➢ Their working is fast but they fatigue easily.
- The cells of skeletal muscles contain many nuclei.
- Example, muscle of arms and legs.

ii. Smooth Muscle:

- Smooth muscles are working smoothly and slowly.
- They are involuntary muscle mean that they do not work under our will.

- They cannot fatigue easily.
- These are non-striated or strapped muscle because they have no alternate light and dark bands.
- Fibers of smooth muscles are multinucleated.
- Examples are muscles of digestive, respiratory, circulatory and urinary tract etc.

iii. Cardiac muscle:

- Cardiac muscles make our heart.
- Composed of striated cells that are branched and each contain a single nucleus.
- They are also involuntary in action.
- They contract and relax rhythmically without getting any fatigue. ➢ Examples are the muscle of our heart.

4. Nerve tissues: -

Nerve tissue is composed of nerve cells called neuron. So, neuron is the basic structural and functional unit of nervous system. They transmit impulses to the brain. These are two types of nervous system.

- Central nervous system
- Peripheral nervous system

Central nervous system: -

Central nervous system is composed of brain and spinal card.

Peripheral nervous system: -

Peripheral nervous system is composed of the nervous that arise from brain and spinal card.

Q31: Difference between plant cell and animal cell?

S.No	Plant Cell	Animal Cell
1	Cell wall is present in plant cell.	Cell wall is absent in animal cell.
2	Plastids are present in plant cell.	Plastid are absent in animal cell.
3	Plant cell have one large vacuole.	Animal cell have many small vacuoles.
4	Centrosomes are absent in plant cell.	Centrosomes are present in animal cell.
5	Plant nucleus is not present in center of a cell.	Animal nucleus is present in the center of a cell.

SHORT QUESTIONS

B. Write short Answer of the following Questions.

Q1: Who proposed the cell theory and what are the main points of the cell theory? Ans:

See Q.No. 8

Q2: Differentiate between simple and compound tissue? Ans:

Simple and compound tissues;

S.No	Simple tissues`	Compound tissues
1	Simple tissues are made of one type of cells.	Compound tissues are composed of more than one type of cells.
2	Meristematic tissue is responsible for primary growth of root and stem.	Xylem tissue transport water and dissolved salt from roots to all part of the plants.
3	Epidermal tissue forms a single outer layer of root, stem and leaves.	Epithelial tissues form the outside cover or the organs.
4	Ground tissue store food.	Muscle tissue produce movement.
5	Collenchyma tissue gives flexibility.	Nerve tissue transmit nerve impulse

Q3: How cell membrane helps in maintaining equilibrium while exchange materials with environment?

Ans: Each cell is surrounded by cell membrane which is selectively permeable membrane. It helps in maintaining equilibrium by controlling outflow and inflow of materials. Selective molecules can move from the cell to outside or from outside to the cell. It freely allows the passage of water and other small molecules such as gases. Other substances like glucose, fatty acid and ions etc can slowly diffuse through it.

Q4: Differentiate between endocytosis and exocytosis?

Ans: See Q No 27

Q5: How does turgor pressure develops in a plant cell?

Ans: Turgor pressure:

In the force within the cell that pushes the plasma membrane against the cell wall.

Most plant cell live in hypotonic environment because there is low concentration of solute in extracellular fluids than in their cells. As a result, the water moves into cytoplasm, then to vacuole by osmosis. As the water enters the vacuole, it increases in size and push the cell contents against cell wall so turgor pressure is developed.

Turgor pressure of the cells is responsible for,

i. Keeping herbaceous plants erect.
ii. It helps in opening and closing of stomata.
iii. Some flower open during day time and close at night time, this is due change in turgor pressure.

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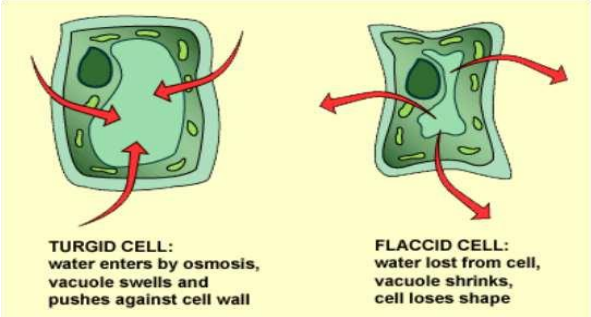
iv. it gives proper shape to the cell.



Long Question

C. Give detailed Answers to the following Question.

Q.1: Root hairs are adapted to absorption and xylem to support. Relate their functions to their structure.

Ans: Absorption of Root:

Root hairs are adopted for absorption because it provides large surface area for absorption. They grow out into the space between the soil particles where they are in direct contact with water. The cytoplasm of the root hairs has higher concentration of salts than the soil water, so water move by osmosis into the root hairs. After their entry into the root hairs. Water and salt must move through the epidermis and cortex of the root, and then into the xylem tissue in the center of the root.

Xylem role in support:

Xylem also helps in the support of plant body because xylem contains fibers. Fibers are elongated cells which give support to the plant. Due to the presence of lignin, the secondary walls of its cells are thick and rigid that is why xylem tissue provides support to the plant body.

Q2: Discuss different types of tissue found in plants. Elaborate your answer with relevant diagrams? Ans: See Q No. 29

Q3: Describe the nervous, muscular and epithelial tissues?

Ans: See Q No. 30

Q4: Write a note on the structure of cell wall, cell membrane, mitochondria and chloroplast of a plant cell?

Ans: See Q.No. 10 (Cell Wall). Q.No. 11 (Cell membrane). Q.No 14 (Mitochondria). Q.No 16 (Chloroplast)

Chapter No.5 Cell Cycle

Q1: What is cell cycle? Describe various phases of interphase of cell cycle with diagram.

Ans: Cell cycle:

The Serious of events that take place in a eukaryotic cell leading to its division is called cell cycle.

Periods of cell cycle:

There are two broad periods of cell cycle

A. Interphase

B. M-Phase (division phase) I-Interphase:

The period between the end of one mitosis and the start of next mitosis is called interphase. Typically, interphase lasts for at least 90% of the total time required for the cell cycle therefore interphase is called the longest phase/ resting phase/ or growth phase of the cell cycle. **Sub Phase of interphase: -**

Interphase has three sub phases. **i.**

G_1-Phase:

It is the first sub phase of interphase.

Main events:

- In this phase newly produced cells grow in size.
- Internal chemical changes occur in cell.
- Internal chemical changes prepare the daughter cells for DNA replication.
- tRNA and mRNA are synthesized
- Ribosome and several enzymes are synthesized in G_1 Phase.

ii. S-Phase (S-Synthesis): It is the second phase of interphase

Main events:

- Cell growth continues throughout S-phase.
- The replication of DNA occurs during this phase.
- Both strands of DNA must replicate and new complementary strands are synthesized.
- Once DNA replication is completed the chromosome become duplicated and the cell become ready to enter the next phase called G_2-Phase.

iii. G_2-Phase: -

The gap between the end of S-phase and the start of M-Phase is called G_2 Phase.

Main events:

- Preparation of protein takes place which are essential for next phase (M-Phase) mainly for the formation of spindle fibers.
- Centriole replicate and move to the either end of the nucleus. It indicates the end of interphase. **G_0 Phase:**

Cells that have temporarily or permanently stopped dividing called **G_0** Phase.

Q2: Define Mitosis? Describe various stages of mitosis in detail? Ans:

Mitosis:

History:

A German Biologist Walther Fleming in the 1880s gave the detailed account of the stages of cell division. He observed that in a dividing cell the nucleus passes through a serious of changes which he called mitosis.

Stage of mitosis:

The process of mitosis can be divided into two main stages. **A.**

Karyokinesis:

It is the division of the nucleus. "Karyo" means nucleus and "kinesis" mean division. **B.**

Cytokinesis:

It is the division of cytoplasm. "cyto" mean cell and "kinesis" mean division.

Various phases of Karyokinesis:

I. Prophase: Main events:

i. Condensation of chromatin network occurs and thread like chromosomes appear.

ii. Each chromosome consists of two chromatids attached with each other at centromere. iii. Nuclear membrane disappears. iv. Centrioles move to the opposite poles.

v. Three sets of spindles fibers arise from each centriole.

a. Astral microtubules:

Microtubules radiate outward and form star shaped structure called aster. **b.**

Kinetochore Microtubules:

Kinetochore microtubules are attached to the kinetochore of chromosome. **c.**

Polar microtubules:

Polar microtubules arise from one pole and come in contact with the microtubules of other poles.

ii. Metaphase:

Main events:

i. During this phase chromosomes arranged itself at the center of cell to form line of chromosome called metaphase plate or equatorial plate. ii. Two spindle fibers from both sides attach with one chromosome.

iii. Anaphase:

Main events:

i. The centromere of each chromosome splits into two parts.

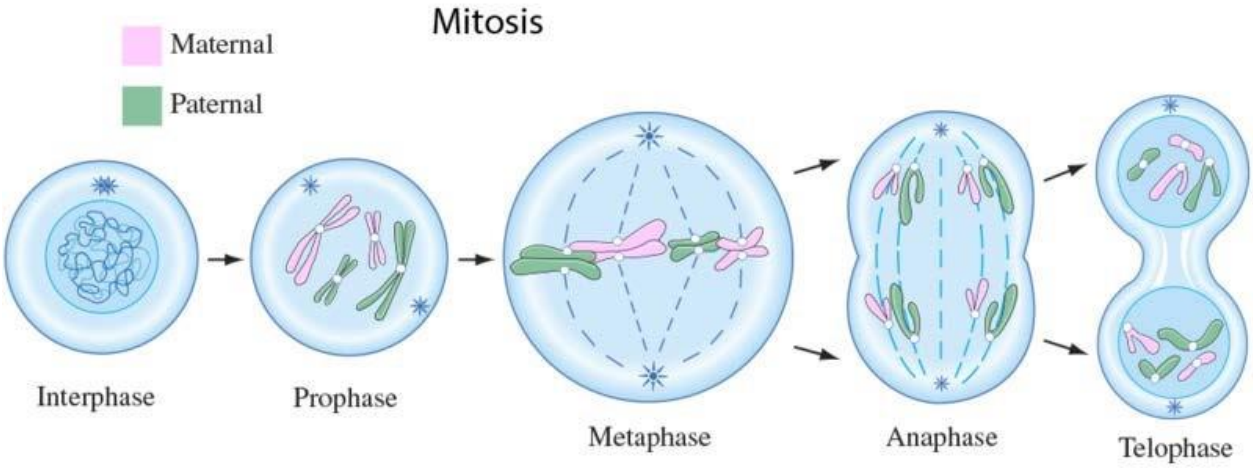
ii. The spindle fibers contract and they pull the chromatids (daughter chromosomes) towards their respective pole. iii. Cytokinesis begins in anaphase.

vi . Telophase:

Main events:

i. In telophase, spindle fibers breakdown.

ii. Chromosomes reach to the respective pole. iii. Chromosomes uncoil to become thin chromatin networks. iv. Two daughter nuclei are formed, each with the same number of chromosomes as were present in the parent nucleus.



Q3: Define Cytokinesis? Write the mechanism of cytokinesis in animal and plant cells? Ans:

Cytokinesis in animal's cell:

Mechanism:

The plasma membrane in the center of the cell folds inward. This fold deepens and extends the entire equatorial plate and divides the parent cell into daughter cells.

Cytokinesis in plants.

Mechanism:

In plant cells during cytokinesis vesicles derived from the Golgi bodies move to the middle of the cell and fuse to form a membrane bounded disc called the cell plate or phragmoplast. The plate grows outwards and more vesicles fuse with it. Finally, the membrane of the cell plate fuses with the plasma membrane and then to the cell wall this result two daughter cells. Each bounded by its own plasma membrane and cell wall.

Q4: Write the significance of Mitosis?

Ans: Significance of mitosis:

Importance of mitosis is the maintenance of the chromosomal set.

Following are the occasions in the life of organisms where mitosis happens. **i.**

Development and Growth:

The number of cells within on organism increases by mitosis and this is the basis of development from a single cell zygote to the multicellular body and the growth. **ii. Cell replacement:**

Mitosis ensures proper replacement of lost cells by new cells. For example, each time you brush your teeth and rinse your mouth, hundreds of dead and worn-out cheek cells are being shed into your saliva. These dead cells are constantly being replaced by the process of mitosis. **iii. Regeneration:**

It is the process of the renewal of organism or the worn-out cells and tissues. For example, Regeneration of tail in lizard. Other organisms have the ability to regenerate the whole body from a piece of the body, e.g. hydra.

iv. Healing of wound.

Mitosis is also responsible for the healing of wound. **v.**

Asexual reproduction in plant:

Some plants reproduce through asexual reproduction. Asexual reproducing in plants occurs due to mitosis.

Example:

- In plants cutting, grafting, budding etc.
- In animals' hydra reproduce asexually by budding.

Q5: Define Meiosis? Write the various stages of Meiosis.

Meiosis:

History:

Meiosis was discovered in 1876, by a German biologist Oscar Hartwig.

Definition:

The type of cell division during which a single parent cell divides to form four daughter cells and each daughter cell have half number of chromosomes as parent cell is called meiosis.

It is also called reduction division as the diploid number of chromosomes (2n) are reduced to haploid (n). **Stage of meiosis:**

There are two stage of meiosis,

A. Meiosis I
B. Meiosis II

Various phases of Meiosis I:

Prophase I:

Main events:

i. Prophase 1 usually accounts for 90% of the total time spent in meiosis.

ii. In this phase chromatin materials condenses and chromosomes become visible.

iii. Homologous chromosomes from pairs. The paring of homologous chromosome is called synapsis. iv. Each pair is called tetrad because each pair has four chromatids.

v. They are also called bivalent because each pair has two chromosomes. vi. The two non-sister chromatids of homologous chromosomes become zipped together, forming complexes known as chiasmata. vii. At the chiasmata, the non-sister chromatids exchange their parts called crossing over. viii. Centrioles migrate to opposite poles and make spindle fibers.

Metaphase I:

Main events:

i. The homologous chromosomes form a line called metaphase plate or equatorial plate. ii. Spindle fibers from one pole of the cell attaches to one chromosomes of each pair while from the opposite pole attach to other chromosome of the homologous pair.

Anaphase I: Main events:

i. During anaphase I spindle fibers shorten and they pull the homologous chromosomes.

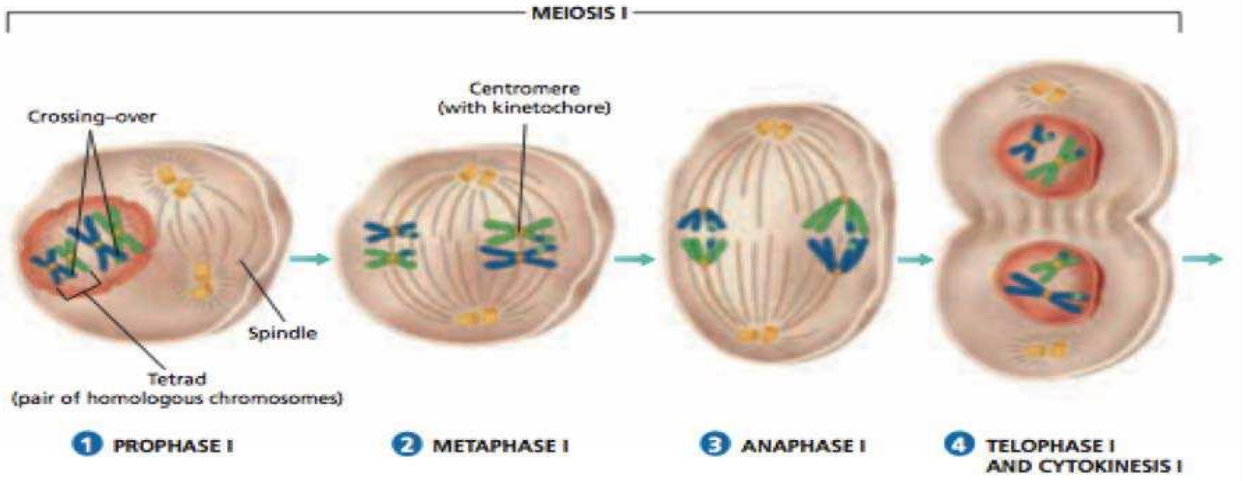
ii. Chromosomes separate and move toward opposite poles of the cell. iii. One haploid set of chromosomes is formed at each pole.

Telophase I. Main events.

i. Nuclear membrane and nucleoli reappears around each set of chromosomes.

ii. Cytoplasm divides to form two daughter cells. iii. Each daughter cell has haploid number of chromosomes. **Cytokinesis.**

The division of cytoplasm occurs and they form two daughter haploid cells.



Meiosis II:

It is the second part of the meiotic division process. Much of this part is similar to mitosis. However, it differs from mitosis is that, parent cells have haploid numbers of chromosomes and the daughter cells also receive haploid number.

Meiosis II is divided into. **i.**

Prophase II:

Main events:

- The chromosomes which are already visible become more prominent.
- Each chromosome has two chromatids and centromere. ➢ Centrioles move to opposite poles and make Spindle Fibers.

ii. Metaphase II:

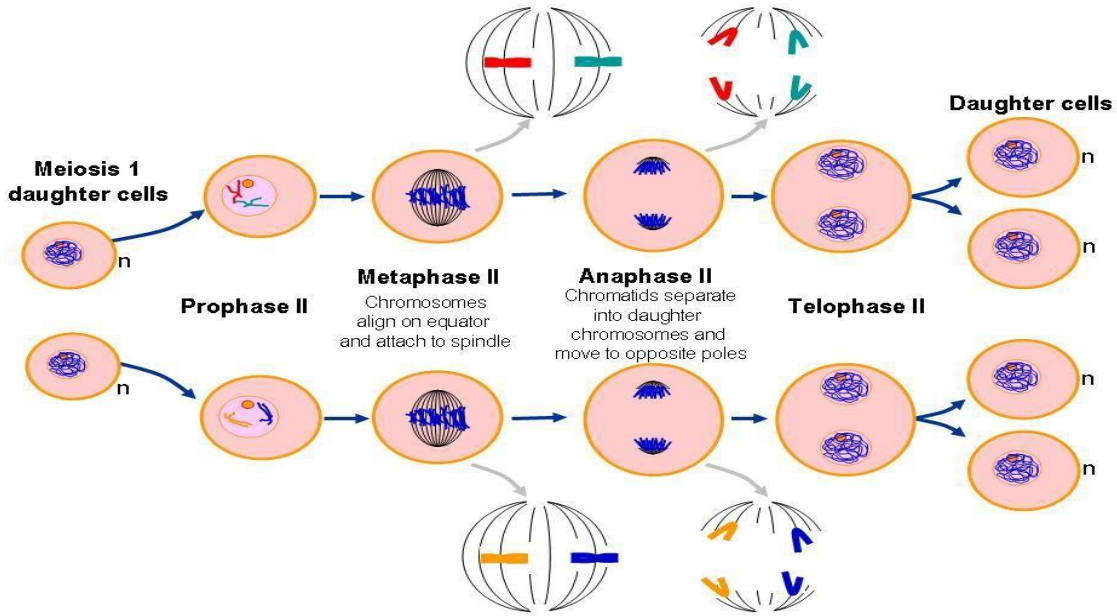
➢ Chromosomes form a line in the center of cell called metaphase plate or equatorial plate.

iii. Anaphase II:

- Centromere of each chromosome spilt.
- The spindle fibers contract and they pull the chromatids towards respective pole.

vi. Telophase II

- Chromatids reach to their respective poles.
- Nuclei and Nuclear membrane reappear.
- Completion of Cytokinesis occurs in telophase II.
- After the division of cytoplasm four daughter haploid cells are formed.



Q6: What is the significance of meiosis?

Ans: Significance of meiosis:

1-Gametes formation:

Meiosis helps in the formation of male gametes (sperms) and female gametes (ova or eggs)

Animals: -

In animals, the parent cells with diploid number of chromosomes undergo meiosis to produce haploid gametes. The male and female gametes fuse together and make a zygote with diploid number. The zygote undergoes mitosis and develops a new diploid organism.

Plants:

In plants, the spore-mother cells undergo meiosis to make haploid spores. These spores grow into haploid structure which produces haploid gametes by mitosis. The gametes combine to produce the diploid zygote.

The zygote undergoes repeated mitosis to become the diploid plants.

3-Maintain constant number of chromosomes: -

Meiosis maintains constant number of chromosomes in zygote by the union of haploid sperms and haploid egg during sexual reproduction. **4-Genetic variation:**

Meiosis helps to create genetic variation among offspring. This variation occurs in chromosomes during genetic recombination.

Q7: Write note on apoptosis and Necrosis?

Ans: i. Apoptosis:

Apoptosis is also called programmed cell death (PCD).

Mechanism:

During apoptosis the cell spilt into small membrane bounded bodies known as apoptotic bodies. Apoptotic bodies cannot damage neighbouring cell. It cannot cause inflammation in neighbouring cells. These apoptotic bodies are engulfed by the neighbouring cells.

Example:

i. Disappearance of tadpole tail during metamorphosis.

ii. Disappearance of web present in human hand and formation of fingers. iii. In the adult organism, the number of cells is kept relatively constant through apoptosis and division.

ii. Necrosis:

It is also called accidental cell death.

Mechanism:

Necrosis is accompanied by the release of special enzymes from the lysosomes. The lysosomal enzymes break cellular components and may also be released outside the cell to break other surrounding cells. Cells that die by necrosis may also release harmful chemicals that damage other cells.

Causes:

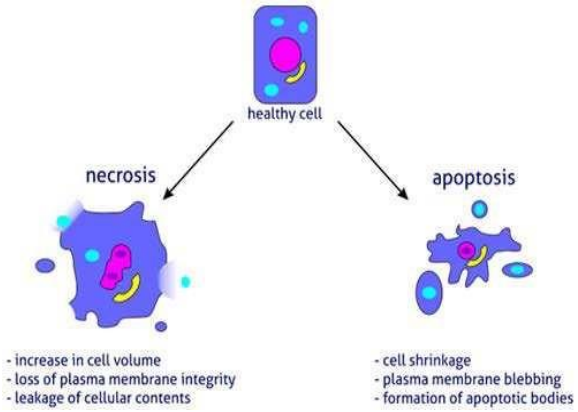
Some physical and chemical events which because necrosis is i

. Radiation

ii. Heat

iii.Trauma iv.Lack of oxygen

v.Blockage of blood flow etc.



SHORT QUESTIONS

B. Write short Answer of the following Questions.

Q1: Define cell cycle and how may phases it is divided?

Ans: It is a serious of events that take place in a cell leading to its division and duplication. Cell cycle is divided into two periods.

I. Interphase

It is further divided into three sub-phases.

i. G_1 - Phase ii. S - Phase iii. G_2 - Phase

II. Division phase:

In this phase the parent cell divides into two daughter cells.

i. Prophase ii. Metaphase

iii. Anaphase

iv. Telophase

Q2: In which type of cell, meiosis take place and why it is important?

Ans: Meiosis takes place in germ cells or gametes. It involves reduction in numbers of chromosome. This helps to maintain the chromosome number constant generation after generation. Also reshuffling of genetic material takes place during crossing over in meiosis that lead to variation and serve as raw material for evolution.

Q3: How does normal mitosis ensures normal life?

Ans: Normal mitosis ensures normal life because

i. Mitosis ensures the exact transmission of daughter cells.

ii. When mitosis occurs in normal way growth of organism take place. iii. Mitosis helps in healing of wounds. iv. Daughter cells formed by mitosis receive same genetic materials as in parent cell.

v. When each cell has normal number of chromosomes, they perform normal life functions.

vi. Regeneration of lost body parts in same animals and vegetative reproduction in plants occurs by mitosis.

Q4: Give at least four differences between mitosis and meiosis?

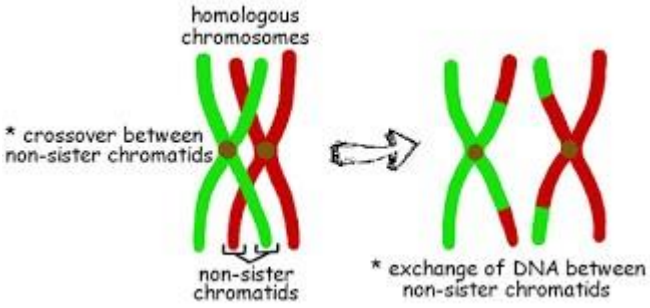
Ans: <u>Difference between mitosis and meiosis;</u>

No	Mitosis	Meiosis
1	The process of mitosis occurs in somatic cells.	The process of meiosis occurs in sex cell or gametes.
2	It produces two daughter cells	It produces four daughter cells
3	The daughter cells receive same number of chromosomes from parent cell	The daughter cells receive half number of chromosomes from their parent cell.
4	Pairing of homologous chromosomes does not occur in mitosis	Pairing of homologous chromosomes occur in meiosis
5	Crossing over does not occur in mitosis	Crossing over occur in meiosis.

Q5: What is chiasma and what is its role in crossing over?

Ans: The point at which two non-sister chromatids of a homologous chromosomes exchange their segments is called chiasma.

At chiasma, the non-sister chromatids of homologous chromosomes exchange their parts. This process is called crossing overs which result in genetic variation.



Long Question

C. Give detailed Answers to the following Question.

Q1: Describe various phases of interphase of cell cycle with diagrams. Ans:
See Q No. 1

Q2: Discuss different events of Meiosis-I with the help of diagram?
Ans: See Q No. 5

Q3: Explain different stages of mitosis with diagrams and at what stage, cytokinesis take place?
Ans: See Q.No 2

Chapter No.6 Enzymes

Q1: Define metabolism and its types?

Ans: Metabolism:

Meaning:

The word metabolism is derived from a Greek word meaning "Change" **History:**
Concept of metabolism was first of all given by Ibn-e-Nafees.

Definition:

The sum of all Chemical reactions that takes place in living organisms is called Metabolism.

Types of Metabolism:

There are two types of metabolism.

i. Anabolism

ii. Catabolism

I. Anabolism:

It is a constructive process in which small molecules combine to form larger molecule is called anabolism. These types of reactions are called anabolic reactions.

Example:

Photosynthesis: $6\ CO_2 + 12\ H_2O$ ----------$\xrightarrow[\text{chlorophyll}]{\text{sun light}}$ $C_6H_{12}O_6 + 6O_2 + 6\ H_2O$

II. Catabolism:

It is a destructive process in which larger molecules breakdown into smaller molecules is called catabolism. Such reactions are known as catabolic reaction.

Example:

Respiration. $C_6H_{12}O_6 + 6O_2 + 6\ H_2O$ ----------$\xrightarrow{\text{sun light}}$ $6\ CO_2 + 12\ H_2O +$ ATP chlorophyll

Q2: Define activation energy? How enzymes lower the activation energy of substrate?

Ans: Activation energy:

The minimum amount of energy required to convert a reactant into product is called activation energy.

Methods of lowering activation energy:

Enzymes lower the activation energy in several ways. They do so by,
i. Altering the shape of the substrates and reducing the amount of energy required to complete the transition. ii. Disrupting the charge distribution. iii. Bringing substrates in the correct orientation to react.

Q3: Write the characteristics of enzymes. Ans:

Characteristics of enzymes:

i. Enzymes are globular proteins in nature and are secreted by cells.

ii. The enzymes functions as catalyst and increase the rate of chemical reaction. iii. They lower the activation energy of reactions. iv. Enzymes are usually very specific for the type of reaction and for the nature of their substrate. v. A small amount of enzyme can bring change in a large amount of substrate.

vi. Enzymes are sensitive to change in pH of the substrate.

vii. Some enzymes work inside the cells called intracellular enzymes. Like mitochondrial enzymes while some enzymes like pepsin work in stomach. viii. Enzymes activity can also be regulated by inhibitor and activators.

Q4: Define the following terms?

Ans: Activators:

Substances which enhance the enzymes activity are called activators.

Co-factors:

The non-protein molecules or ions required by enzymes for activity are called Co-factors. e.g. metallic ions and organic molecules. **Co-enzymes;**

If the organic cofactor is loosely attached with the enzyme, they are called Co-enzymes mostly coenzymes are vitamins riboflavin, thiamine, folic acid. **Prosthetic group:**

It is organic cofactor is tightly attached with enzyme they are called prosthetic groups.

Apo enzymes;

Enzyme without cofactor is called Apo enzymes.

Holoenzyme:

Enzyme with cofactor is called Holoenzyme. OR Complete enzyme is called Holoenzyme.

Substrate:

The substances on which enzyme act are called substrate.

Active site:

A region on an enzyme where substrate binds during reaction is called active site.

Activation energy:

The amount of energy required to start a biochemical reaction is called activation energy.

Q5: Why enzymes are specific in their function discuss?

Ans: Enzymes are very specific in their action because of their active site. An enzyme generally catalyzes only one kind or one type of chemical reaction. Therefore, they are specific for certain substrate. One particular enzyme cannot speed up many different types of reactions.

No reaction can occur in a cell unless its own specific enzyme is present. **Example:**

Urea ----------Urease → Ammonia

Starch ----------Amylase → Glucose

Protein ----------Proteas → Amino acid

Lipid ----------Lipase → fatty acid

Cellulose ----------Cellulase → Glucose

Q6: Describe the mechanism of enzyme action?

Ans: There is a small portion in the enzyme molecule that is actually involved in catalysis. This catalytic region is called active site.

When an enzyme joins its substrate, the complex is formed called enzyme substrate complex. As a result of interaction between an enzyme and its substrate product is formed.

E + S ⟶ E S C ⟶ P + E

E = enzyme S = Substrate P = Product **Mechanism:**

Two models have been proposed to explain the mechanism of enzymes action. These are,

1. Lock and key model.
2. Induced fit mode.

1. Lock and key Model:

History:

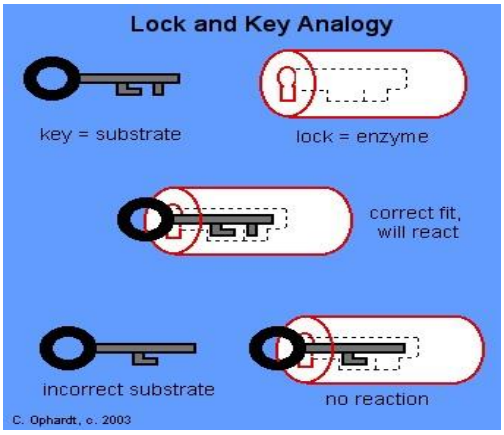
This model was proposed by a German biochemist Emil fisher in 1894.

Statement:

According to this model active site of enzyme and substrate have specific geometric shape. The substances molecule exactly fits in the active site of enzyme just like a lock and a key. Enzyme is the lock and substrate are the key. This model suggests that the active site is a rigid and nonflexible structure.

Mechanism:

According to lock and key hypothesis the enzyme (key) combined with a specific substrate (lock) and chemically changing the substrate into a new product. No change occurs in the enzyme during or after the reaction.



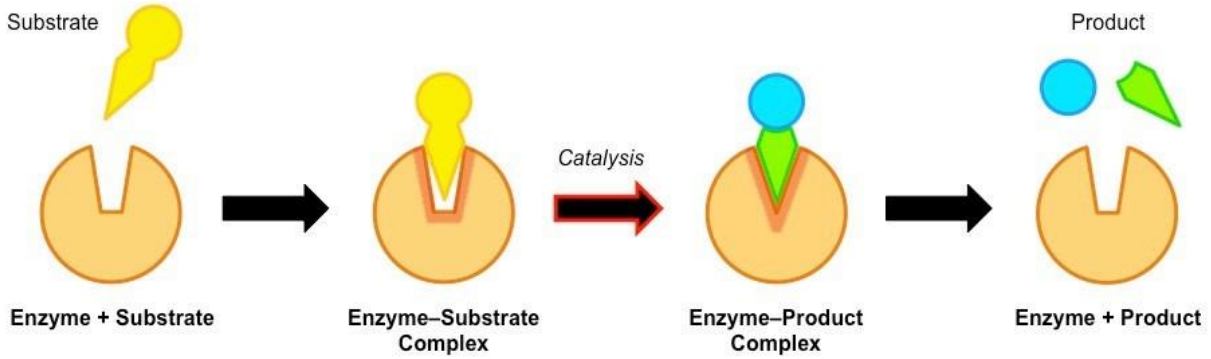
2. inducted fit model:

History:

This model was first proposed by American Biologist DanielKoshland in 1958. It is also called Hand and Glove model. According to this model active site of enzyme are flexible.

Mechanism:

Koshland suggested that when a substrate combines with an enzyme it induces changes in the enzyme structure. This change helps the enzyme to perform its catalytic activity more effectively. So, the active sites of the enzymes are not rigid and are flexible.



Q7: What is the effect of temperature, PH and substrate concentration on enzymes activity?

Ans: I. Effect of temperature:

Enzymes are very sensitive to the change in temperature. With increase in temperature the enzymes activity also increases but there is limit to the increase. This limit is called optimum temperature. The optimum temperature for human enzyme is between 35 – 40 C^o and the average

temperature is 37C°. When temperature is above 40C° denaturing of enzyme quickly starts. At 0 C° the enzyme becomes inactive and cannot perform their function.

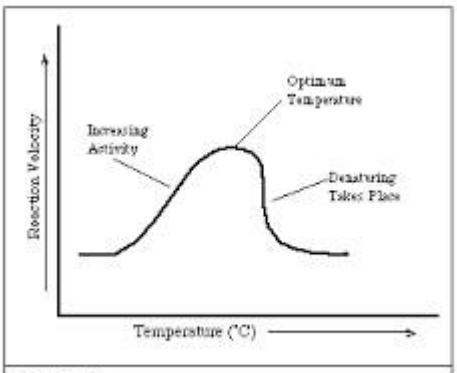


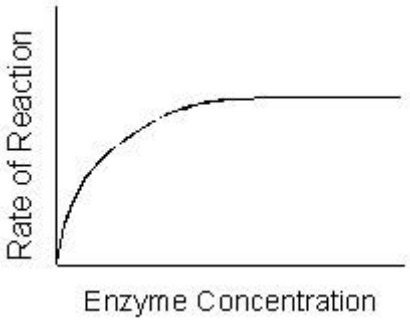
FIGURE 13
Effect of temperature on reaction rate

ii.

Effect of pH:

The activity of enzymes varies with change in pH. The pH at which the activity of an enzyme is maximum called optimum pH. Optimum pH value for most enzymes is between 6-8. The activity of enzyme pepsin in stomach work best at a pH of 2 and trypsin at a pH 8. Change in pH can stop enzyme activity. Any change in Ph can lower the enzymatic activity. Extreme changes in the pH of solutions denture the enzymes. **iii. Effect of substrate concentration:**

The rate of reaction of reaction increases with the increase in substrate concentration. When enzyme become saturated. At saturation point the reaction cannot increase further enzymes are said to be saturated when all of its active sites are occupied by the substrate.



SHORT QUESTIONS

C. Write short Answer of the following Questions.

Q1: Differentiate between lock and key model and the induced-fit model?

Ans Difference between lock and key model and the induced-fit model:

Characters	Lock & Key Model	Induced Fit model
History	This model was proposed by a German biochemist Emil Fischer in 1894.	This model was first proposed by American Biologist Daniel Koshland in 1958.

Statement	According to this model active site of enzyme are rigid.	According to this model active site of enzyme are flexible.
Geometry	No change occurs in the enzyme during or after the reaction.	The geometry of enzymes changes during reaction.

Binding	Enzyme can only bind with a single substrate	In the induced-Fit model, multiple substrates can bind with an enzyme.
Active site	Active site does not change its shape.	Active site changes their shape slightly.

Q2: In what way does an enzyme affect the chemical affect the chemical reactions its catalysis?

Ans: Enzymes are biological catalysts. They speed up the chemical reaction by lowering the activation energy needed for the reaction.

Enzymes lower the activation energy by several ways.

- Altering the shape of substrate
- Disrupting the charge distribution
- Bringing substrates in correct orientation to react.

Q3: What will be the effect on digestion of we take some digestive enzymes from outsides?

Ans; If we take some digestive enzymes from outside the digestion will efficiently and effectively occur. It is very important that we preserve the body's ability to make enzymes. If supplemental plant digestive enzymes are taken with a meal, these digestive enzymes begin their work immediately. The supplemental digestive enzymes will break down the food, thus saving the body from having to release as many of its own enzyme.

Q4: What is meant by denaturation of enzymes?

Ans: The change in structure of enzymes resulting from the breakdown of the weak ionic and hydrogen bonding in enzymes is called denaturation of enzymes.

Q5: How are enzymes specific for the substrate?

Ans: Enzyme are very specific in their action, An enzyme catalysis only one specific reaction. Enzyme due to its specific chemical nature and structure can react with a specific substrate. That's why one particular enzyme cannot speed up different types of reactions. Proteases convert only protein into amino acid and lipase convert lipids into fatty acid.

Q6: What is the term used to describe the temperature and pH at which enzymes can work most effectively in a reaction?

Ans: All enzyme work at specific temperature, increase or decrease in specific temperature effect the rate of enzymes action. The temperature at which the enzymes works best is called optimum temperature. Example:
Optimum temperature for human enzymes is between 35-40 C°. Most enzymes work best at a pH between 6-8 which is called optimum pH. So, the term which used to describe the temperature and pH on which the enzymes work properly is called optimum temperature.

Long Question

C. Give detailed Answers to the following Question.

Q1: Describe the factors which affect the enzymes activities? Ans:
See Q No. 7

Q2; Explain the mode of action of an enzyme in a reaction? Ans:
See Q No. 6

Q3: what are the various properties of enzymes? Ans:
See Q No. 3

Q4: The diagram below shows the relationship between an enzyme, a substrate and the products of an enzyme catalyzed reaction?

a): What is represented by the parts labelled A,B and C in the diagram?
Ans: The parts labeled "A" shows a substrate, "B" shows an enzymes and "C" shows the products.

b) Name two properties of enzymes, that are represented in this diagram, what will happento the chemical reaction if the enzyme is removed?
Ans: The enzyme in this diagram shows the active site, enzyme-substrate complex and the enzyme remain unchanged after reaction is completed.
When enzyme is removed the chemical reaction slows down or even stops.

c) What will happen to the rate of reaction if the reaction temperature is raised steadily?
i. From 25 C° to 35 C° and ii. From 40 C° to 60 C°
Ans: If the reaction temperature is changed from 25C° to 35C°, the rate of reaction will increase. But if the temperature of reaction is from 40C° to 60C° the reaction will stop.

d) What term is used to describe the condition of the enzyme when it is heated to a temperature of 60C°and above?
Ans: The term used to describe the condition of the enzyme when it is heated to a temperature of 60C° and above is denaturation.

Q No. 5: The graph below shows the rate of an enzymatic reaction?

a) According to graph A, at which temperature the enzyme activity is highest? Whentemperature increase above this point, what will happen to the enzyme?

Ans: According to graph A, the enzyme activity is maximum at 40 C^o. When temperature increase above this point, the enzymes becomes denature and decrease in the rate of reaction occurs sharply.

b) According to graph B, what is the optimum pH for i) pepsin and ii) lipase? As pH movesaway from the optimum value, what will happen to the enzyme activity?

Ans: According to graph B, the optimum pH for pepsin is 2, and pH for lipase is 8. As pH moves away from the optimum value, the enzyme activity decrease and hence the rate of reaction decrease.

Chapter No.7 Bioenergetics

Q1: Define Bioenergetics, Metabolism, type of Metabolism and also write the importance of Bioenergetics? Ans: Bioenergetics; Definition:

Bioenergetics is the study of energy relationships and energy transformations(conversations) in living organisms.

Metabolism:

Meaning:

The word metabolism is derived from a Greek word meaning "change".

History:

Concept of metabolism was first of all given by Ibn-e-Nafees.

Definition:

The sum of all Chemical reactions that takes place in living organisms is called metabolism. **Types of Metabolic reactions:**

There are two types of metabolic reaction.

i) Endergonic reaction (anabolism) ii) Exergonic reaction (catabolism)

i) **Endergonic reaction:**

Definition:

The reaction which required energy is called endergonic reaction. **(OR)** The reaction in which energy is stored is called endergonic reaction. **Example:**

Respiration

Importance of Bioenergetics:

- Sun is the ultimate source of energy for all organisms.
- Energy is transforming from one form to another form within living organisms.
- Living organisms use energy for various life activities.
- The green plants capture solar energy and convert it into store chemical energy in the process of photosynthesis.
- This energy is then transformed to mechanical and heat energy during Respiration.

Q2. What is oxidation Reduction reaction? Write its importance. Ans;

Redox reaction:

Definition:

A chemical reaction is which both oxidation and reduction occurs called Redox reaction.

Oxidation: Definition:

Addition of oxygen or loss of hydrogen or electron is called oxidation. **Reduction:**

Definition:

The gaining or electron or hydrogen is called reduction.

Oxidation – reduction reaction:

Those reactions in which oxidation and reduction occur simultaneously is called oxidationreduction or redox reaction.

Photosynthesis and respiration processes are basically oxidation-reduction processes. During photosynthesis energy of sunlight is absorbed by plants and use CO_2 and H_2O to make food molecule which involve oxidation-reduction reactions.

Respiration is also oxidation-reduction reaction during which food molecule are broken down into CO_2 and H_2O and energy is released in the form of ATP which are used by the cell for life activities.

Importance:

Due to redox reaction photosynthesis and respiration occur that produce energy which sustains life on earth.

Q3. What is ATP Molecule? Describe the structure of ATP Molecule?

Ans: ATP Molecule:-

The major energy currency for all cells is a nucleotide called ATP (Adenosine Tri Phosphate).

Discovery of ATP: ATP was discovered in 1929 by Karl Lohmann.

Structure:

The structure of ATP molecule consists of three components.

i. Adenine (Double ring nitrogenous base). ii. Ribose sugar (5 carbon carbohydrate). iii. Phosphate groups (three molecule of phosphoric acid).

In ATP Molecule the adenine is covalently bonded to ribose sugar to form a Molecule called Adenosine to form ATP Molecule.

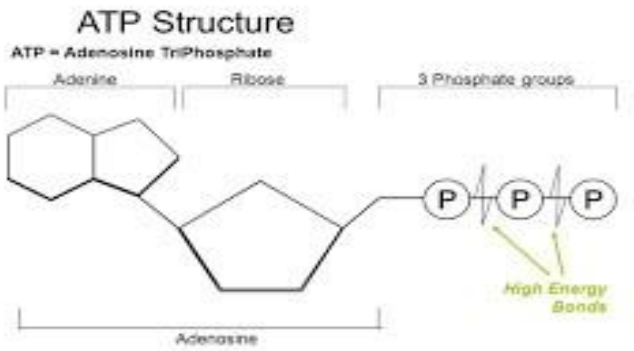
Bonds in ATP Molecules;

There are two types of phosphate bonds in ATP Molecules. **I.**

High energy bond:

These bonds are represented by symbol (~) and these bonds yield more energy (7.3 K.cal) on hydrolysis. **ii. Low energy phosphate bond:**

These bonds are represented by straight line (------). And they yield less energy on hydrolysis.



Q4. Write note on the synthesis, breaking and recycling of ATP?

Ans: Adenine is a nitrogenous base when covalently bonded to five carbon Ribose making a Molecule Adenosine.

Adenine + Ribose → Adenosine

i) When Phosphate Molecule bonded with Adenosine forming a nucleotide called AMP (Adenosine mono phosphate)

ii) By addition of phosphate with AMP molecules called ADP (Adenosine Di Phosphate)

AMP + Pi + energy --→ ADP

iii)By the addition of another phosphate with ADP form ATP.

ADP + Pi + energy --→ ATP **Breaking of ATP:**

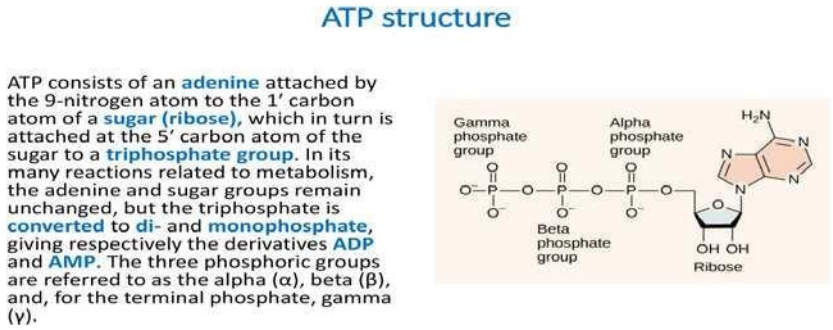
ATP + H_2O ----→ ADP + Pi + energy (7.3 Kcal)

AMP cannot hydrolyze further.

Recycling:

ATP Molecules are constantly hydrolyzed by the cell into ADP and inorganic phosphate and energy is obtained for cellular functions.

At the same time ATP Molecules are constantly regenerated from ADP and phosphate using energy released from the breakdown of glucose Molecule in the process of Respiration. In this way a constant cycle of ATP broken down and reformation goes on in the living organism.



Q.5. Define photosynthesis? Write its importance.

Ans: Photosynthesis:

Terminology: -

The word photosynthesis is derived from two Greek words.

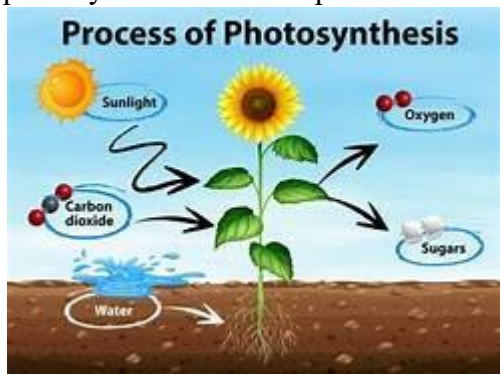
i) Photo mean light ii) Synthesis mean manufacture

Definition:

The process by which green plants prepare their own food (carbohydrates) from carbon dioxide and water in the presence of sunlight and chlorophyll and releasing oxygen as by product is called Photosynthesis.

Chemical equation:

- Photosynthesis is energy storing process.
- Due to photosynthesis green plants prepare their own food hence they are called Autotrophic organisms.
- Heterotrophic organisms depend for their energy requirement on green plants. ➢ Without photosynthesis life is impossible.



Q.6. Write the Role of Chlorophyll and Sunlight in Photosynthesis?

Ans: Chlorophyll:

Definition: -

The organic Molecules which enable plants to capture light energy and convert it into chemical energy for the formation of glucose ($C_6H_6O_6$) is called chlorophyll.

Location:

In plants and algae chlorophyll is present in chloroplast while in photosynthetic prokaryotes it is present in the cell membrane.

Photosystem:

Photosynthetic Pigments are organized in the form of clusters in the thylakoid membranes of chloroplast called photosynthesis.

Types of chlorophyll:

There are many types of chlorophyll.

Chlorophyll a,b,c,d,e and Bacteriochlorophyll

Chlorophyll a,

It is the main pigment found in all green plants and Algae except bacteria.

Chlorophyll b,

It is a photosynthetic pigment found in all higher plants and green Algae. **Chlorophyll (c,d,e):**

It is found in various groups of Algae.

Absorption of light,

Chlorophyll (a) absorb mainly blue and red portion of sunlight. The green portion is mainly reflected therefore chlorophyll appear green. Chlorophyll absorb blue light have wavelength 390430nm and red light have wavelength 670-700nm.

Role of light:

Sun is the main source of energy for all living organisms. Only a small amount of the total sunlight that strikes the green plants is used in the process of photosynthesis. This small portion of sun light sustains all life forms on earth.

Q.7. Describe the structure of chloroplast?

Ans: Chloroplast consist of three components

i. Outer membrane ii. Grana iii. Stroma

i. Outer membrane:

It is the double membrane covering that enclose the grana and stroma. **ii.**

Grana (sing . granum):

The granum is seen just like a pile of coins which is composed of stack of thylakoids. **Thylakoid: (Gr: thylakoid mean sac or pouch)**

Function;

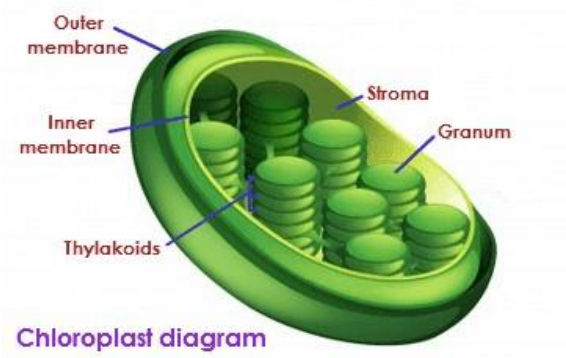
Light reaction of photosynthesis occurs in grana of chloroplast. **iii.**

Stroma:

It is central large space in chloroplast contain enzymes and gel like solution called matrix.

Function:

Dark reaction of photosynthesis occurs in stroma of chloroplast.



Q8. Write the process of intake of carbon dioxide and water?

Ans: Intake of CO_2:

CO_2 is present in air (0.03 %) and is one of the raw materials of photosynthesis. CO_2 is diffuse from outside air into the intercellular spaces of leaf through stomata. Stomata are small opening scattered particularly in the lower epidermis of leaf. Each stomata is guarded by two kidney shaped guards cell. Opening and closing of stomata regulates the diffusion of CO_2, water vapours, and O_2 between the intercellular spaces of leaf mesophyll and the external air. After diffusing into the intercellular spaces, CO_2 attaches to the wet surface of mesophyll cells. then it diffuses into the green cells and enters the stroma of chloroplasts. In the dark reaction of photosynthesis, CO_2 molecules are reduced to form glucose molecule.

Intake of water:

Water is also an essential requirement of photosynthesis. Water is absorbed by the roots of plants from the soil. It is then transported upward to their stem and leaves through xylem vessels. Most of this water is transpired from the leaves while a small portion is used in photosynthesis.

Q.9. Enlist the main events in mechanism of photosynthesis? Ans:

Mechanism of Photosynthesis:

The process of Photosynthesis is completed in two main steps.

i. Light reaction (light dependent reaction).
ii. Dark reaction (light independent reaction).

i. Light reaction (light dependent reaction)

- The reaction is also called light dependent reaction.
- Light reaction takes place in the grana of chloroplast.
- Chlorophyll molecules absorb light energy and converted into chemical energy.
- During light reaction photolysis take place.
- In photolysis water molecules are broken down into hydrogen and oxygen in the presence of specific enzymes.
- Oxygen is released while hydrogen atoms are used to reduce NADP into NADPH.
- In this process various kinds of energy producing compounds such as energy source.

Equation:

$$2H_2O + 2NADP^+ + 3ADP + 3P_i \rightarrow O_2 = 2NADPH = 3ATP$$

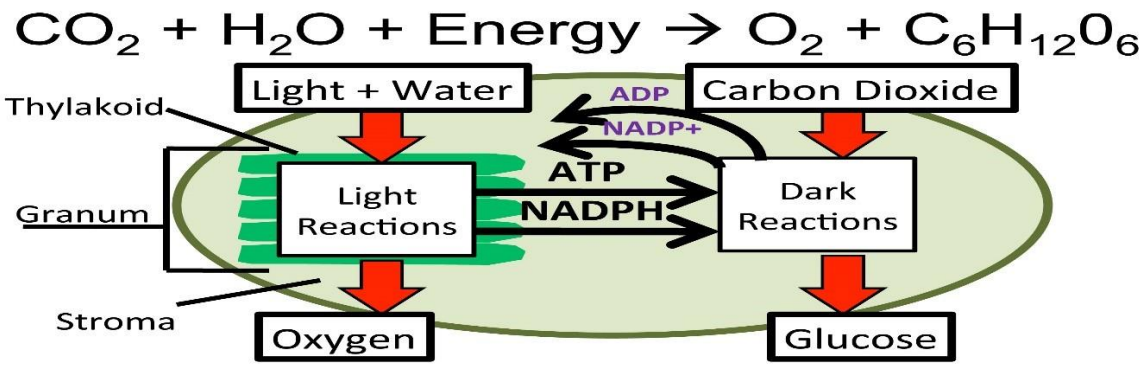
ii. Dark reaction (Calvin Cycle):

- Dark reactions were discovered by Melvin Calvin. That way this reaction is also called Calvin Cycle.
- This is also called light independent reaction.
- Dark reaction takes place in the stroma of chloroplast.

- Chemical energy from the light reaction is used to reduce carbon dioxide for the synthesis of carbohydrates.

Equation:

$$6CO_2 + 24H + \text{Chemical energy} \rightarrow C_6h_6O_{12} + 6H_2O$$



Q.10. What is limiting factor? Write the concept of limiting factors in photosynthesis.

Ans: Limiting factor:

The concept of limiting factor was stated by leibig's law of limiting factors. This law states that,

"When a chemical process is controlled by more than one factor then the rate of the chemical process will be limited by the factor which is present in minimum quantity in relation to other".

Simple definition:

The absence or deficiency of any environmental factor which can decrease the rate of a metabolic reaction is called limiting factor.

Limiting factor for photosynthesis:

The process of photosynthesis is affected by many factors such as light, chlorophyll, Co_2, water and optimum temperature but the rate of photosynthesis is limited by the factor which is in minimum value. **Example:**

CO_2 is one of the requirements of photosynthesis. When all the other requirements for photosynthesis are optimum and only CO_2 is low. Then the low amount of CO_2 will lower the rate of photosynthesis and thus act as a limiting factor. **i. Effect of CO_2 Concentration:**

CO_2 comes from the air there are 0.03% CO_2 atmosphere. Concentration of CO_2 almost remains constant in air because it is produced in respiration in the bodies of living organisms. When the stomata are closed, the concentration of CO_2 almost remains constant in air because it is produced in respiration in the bodies of living organisms. When the stomata are closed, the concentration of CO_2 falls down in the Mesophyll tissues. This lower down the rate of photosynthesis. Without CO_2 photosynthesis does not occur. **iii. Effect of temperature:**

The optimum temperature is necessary for normal photosynthesis. Generally, temperature ranging between 20C° to 30C° is most suitable temperature. When temperature exceeds 30C°, the rate of photosynthesis lower down and below 20C°the rate of photosynthesis decreases while on freezing temperature photosynthesis completely stops and at 45C°the photosynthesis becomes stop.

Q11: Define respiration and its types.

Ans; Respiration:

Oxidation reduction process by which organic food is broken down to carbon dioxide and water and release energy inside the cell is called respiration.

Glucose is the most common food used in this process. The purpose of respiration is to release energy for the living processes. Respiration is common to all living organisms because all of them need energy for life activates.

Types:

There are two main types of respiration. **i.**

Anaerobic respiration;

The breakdown of organic food molecules to release energy in the absence of oxygen is called anaerobic respiration.

It is also called fermentation. It involves incomplete breakdown of organic food molecules and only a small amount of energy is released. It occurs in the cytoplasm of the cell. **ii. Aerobic respiration:**

The breakdown of organic food molecules to release energy in the presence of oxygen is called aerobic respiration. i. Glycolysis ii. Kreb cycle iii. Electron transport Chain.

Q.12: Compare lactic acid fermentation with alcoholic fermentation?

Ans: Lactic Acid Fermentation:

It is called lactic Acid fermentation because the end product is Lactic Acid. It occurs in microorganisms just like bacteria during the fermentation of milk. It also occurs in muscle cells when the energy demand is high.

Steps:

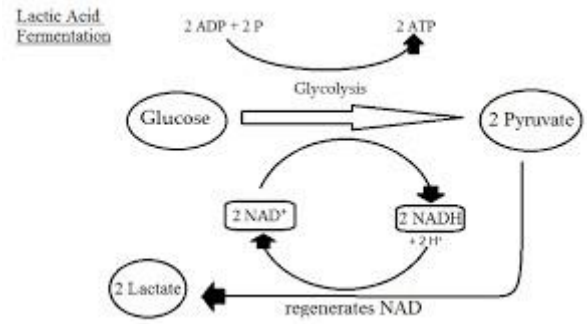
It is completed in two steps.

i. In this step glucose molecule are broken down into pyruvic Acid by the use of 2ATP Molecules and produce 4ATP Molecules So the net ATP produce in Glycolysis is 2ATP.

Glucose + 2ATP → 4ATP + 2 pyruvic Acid.

ii. In the second step pyruvic Acids is reduced by NADH+H (co-enzyme) and convert into lactic acid.

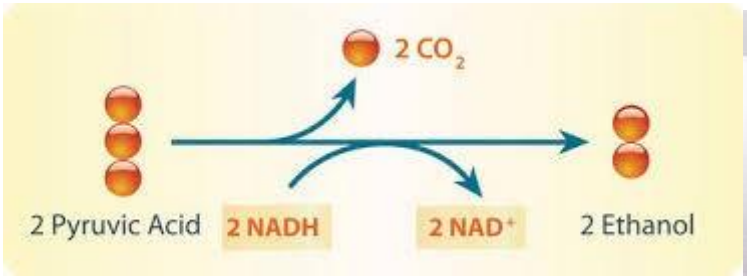
Pyruvic Acid + NADH → Lactic Acid + Co_2.



Alcoholic fermentation:

In alcoholic fermentation the end product is alcohol. It occurs in yeast and in some bacteria. i. The first stop is Glycolysis

Glucose + 2ATP → 4 ATP + pyruvic Acid ii. In the second step pyruvic Acid is reduced by NADH+H to ethyl Alcohol (ethanol). In alcoholic fermentation also two ATP molecules are Pyruvic Acid + NADH →Alcohol+ CO_2.



Q.13: Describe various steps of Aerobic Respiration.

Ans: Aerobic respiration:

The breakdown of organic food molecules to release energy in the presence of oxygen is called aerobic respiration.

Reaction:

$C_6H_6O_{12} + 6O_2 \rightarrow 6CO_2\ 6H_2O + 36$ ATP.

Steps of aerobic respiration:

Aerobic respiration completes in three steps.

I. Glycolysis

II. Kreb cycle

III. Electron transport chain. **I.Glycolysis: Meaning:**

- Glyco mean glucose.
- lysis mean splitting.

Definition:

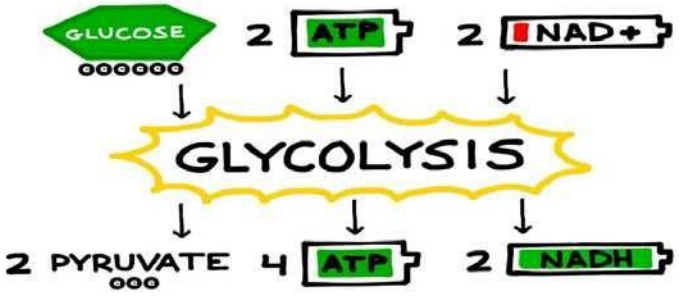
The stepwise enzymatic breakdown of glucose up to the formation of Pyruvic Acid is called glycolysis.

Location:

It takes place in cytoplasm.

Explanation:

In this step a glucose molecule (6-c) is broken into two molecules of pyruvic acid (3-C). In this process two ATP molecules are used and four are produced. So, the net gain of two ATP molecules.



ii.

Krebs cycle:

Definition:

The cyclic process in which high energy pyruvic acids are completely oxidized into CO_2 and H_2O is called kreb cycle.

Location:

It occurs in mitochondria because inside mitochondrial necessary enzymes are present for reaction.

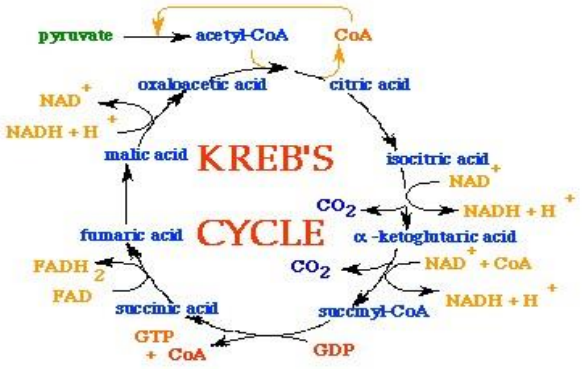
Discovery:

This step was first discovered by sir Hans krebs therefore named after his name kreb cycle.

Explanation:

Before entering to kreb cycle, pyruvic acid is changed into a 2-Carbon compound called acetyl-

Coenzyme A. It then goes through a series of reaction in which it is completely oxidized. These reactions produced CO_2 along with ATP, NAD and FAD, NAD and FAD are also reduced into



NADH and FADH respectively. **iii.**

Electron transport chain:

Definition:

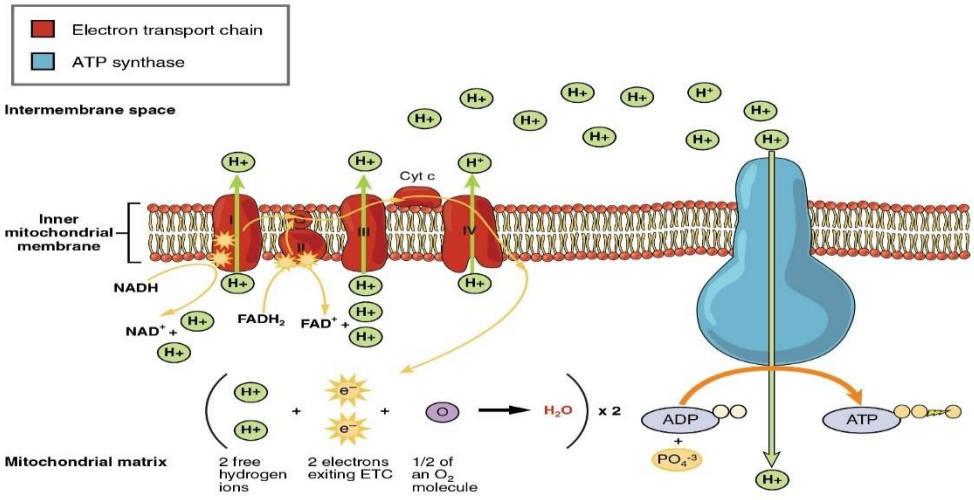
The final step of aerobic respiration in which the oxidation of reduced Coenzyme NADH and FADH take place that produce in glycolysis and kreb cycle.

Location:

It is the last step of aerobic respiration that occurs in mitochondria.

Explanation;

During this step two electrons are released from NADH and FADH. These electrons are than pass a series of electron carrier called cytochrome. During the transport from one cytochrome to the other electron loss energy. This energy is used to form ATP from ADP and P_i. it the end, oxygen molecule accept electron to form water.



Q.14: How much energy is produced during respiration?

Ans: The complete oxidation of one molecule of glucose into CO_2 and water generate 38 ATP. During glycolysis, two ATP molecules are also used. So, there is net gain of 36 ATP from one glucose molecule. These ATP are generated step wise some during glycolysis, some during kreb cycle and many are generated during electron transport chain. Each NADH generates 3 ATP molecules and each FADH molecule produce 2 ATP molecule.

Q.15: Compare Aerobic respiration with anaerobic respiration?

Properties	**Aerobic Respiration**	**Anaerobic Respiration**
Presence of Oxygen	Yes	No
Number of ATP as net profit	36	2
Location	It takes place in cytoplasm and mitochondria	It takes place only in cytoplasm
Food breakdown	Complete breakdown of food molecules occurs	Incomplete break down of food molecules occurs
Importance	Major source of energy for most organism	Source of energy for anaerobic organisms. Source of many products like ethanol and cheese etc.

Q.16: Compare photosynthesis with respiration.

Properties	**Photosynthesis**	**Respiration**
Metabolism	Anabolism	Catabolism
Energy used/ production	Used of light energy to store it in the form of bond energy	Bond energy transformed into chemical energy of ATP
Site of occurrence	Chloroplast	In cytoplasm and mitochondria
Time of occurrence	In daytime only, in the presence of light.	All the time
CO_2 and H_2O	CO_2 and H_2O are used as a raw material	CO_2 and H_2O are produced as a waste product
Oxygen	Oxygen is produced as a by product	Oxygen is required for Aerobic Respiration.

SHORT QUESTIONS

Q1. Why ATP is regarded as the currency of the living cells?

Ans: Adenosine triphosphate (ATP) is energy rich molecules. ATP is hydrolyzed by the cells into ADP and inorganic phosphate during which 7.3 K Cal energy is obtained. This energy is used by living organisms for all cellular activities.

ATP is constantly regenerated from ADP and phosphate for which energy is obtained from the breakdown of glucose molecule in the process of respiration.

Since ATP is the main source of energy therefore it is known as currency of living cells.

Q2: What is the role of pigment during photosynthesis?

Ans: Pigments are the complex organic substances that absorb visible light and convert it into chemical energy for the formation of carbohydrates. Different pigments absorb light of different wavelength (different colours). Chlorophyll (a) is the main photosynthetic pigment.

Chlorophyll (a) absorb mainly blue and red portion of light. The wave length of blue light is 390430 nm and the wave length of red light is 670 – 700 nm.

Q3: Draw the structure of ATP molecule?

Ans: See Q.3.

Q4: Compare lactic acid fermentation with alcoholic fermentation?

Ans: <u>Comparison of Lactic acid fermentation with alcoholic fermentation:</u>

No	Lactic acid fermentation	Alcoholic fermentation
1	It is the type of fermentation in which the end product is lactic acid	In this type the end product is ethyl alcohol and CO_2.
2	It occurs in two steps first step is glycolysis and in second step pyruvic acid is reduced into lactic acid.	It also occurs in two steps. After glycolysis the pyruvic acid is converted into ethyl alcohol and CO_2.
3	Yogurt is formed by bacterial fermentation of milk	It occurs in yeast and other bacteria
4	It also occur in human muscles	It also occurs in plants.
5	$C_6H_{12}O_6 + 2ATP \rightarrow 2(C_3H_6O_3) + 4ATP$ $2(C_3H_4O_3) \rightarrow 2(C_3H_6O_3)+2CO_2$	$C_6H_{12}O_6 + 2ATP \rightarrow 2(C_3H_6O_3) + 4ATP$ $2(C_3H_4O_3) \rightarrow 2(C_3H_5OH)+2CO_2$

Q 5: Why are oxidation and reduction important for plants? Ans:

See Q No. 2.

Long Question

C. Give detailed Answers to the following Question.

Q1: Explain the mechanism of photosynthesis?

Ans: See Q No.9

Q2: What is the concept of limiting factor? What are the different limiting factors for photosynthesis? Ans: See Q No. 10

Q3: Why aerobic respiration is considered as to be more efficient then anaerobic respiration?

Ans: Aerobic respiration is considered to be more efficient then an aerobic respiration because during aerobic respiration complete breakdown of glucose molecules occurs in the release of all energy stored in the bond of glucose.

During aerobic respiration one glucose molecule gives 36 ATP molecules.

Anaerobic respiration is less efficient then aerobic respiration because Anaerobic Respiration is the incomplete break down of glucose molecule. In the reaction of anaerobic respiration one glucose molecule release only 2 ATP molecules.

Q4: Aerobic respiration generates more ATP molecules than an aerobic process. Which processes of aerobic respiration are responsible for this higher generation of ATP and how?

Ans: Aerobic respiration generates more ATP molecule than anaerobic respiration. Because in aerobic respiration 36 ATP generated while in anaerobic respiration only 2 ATP molecules are producing.

In aerobic respiration ATP molecules are produced stepwise in glycolysis, kreb cycle and electron transport chain. Higher ATP formation takes place in electron transport chain which is the last and final step of cellular respiration.

ETC occurs in the innermost membrane of mitochondria. In this process oxygen is utilized therefore these reactions are called oxidative phosphorylation.

At the end of the ETC, water (H_2O) and ATP is made. Depending on how many NADH molecules are available the electron transport chain makes a total of 32 or 34 ATP. These 32-34 ATP combined with 2 ATP from glycolysis and 2 ATP form the Krebs Cycle means that one molecule of glucose (sugar) can make a total of 36-38 ATP.

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Chapter No.8 Nutrition

Q.1: Define Nutrition and its types?

Ans: Nutrition:

Definition:

"The Process in which food is obtained or prepared, absorbed and converted into body substances for growth and energy is called Nutrition.

Nutrient:

Nutrients are the materials (elements & compounds) that organisms obtain and use for maintaining life.

Types:

i. Autotrophic nutrition:

The nutrition of those organisms which prepare their own food is called Autotrophic Nutrition. **ii. Heterotrophic Nutrition:**

The nutrition of those organisms which cannot prepare their own food and depends on other organisms for food is called Heterotrophic Nutrition.

Q2: Define Nutrient and its types?

Ans: Nutrient:

Definition:

Nutrients are the materials (elements & compounds) that organisms obtain and use for maintaining life.

Types:

There are two types of nutrients. **i.**

Macronutrients:

The nutrients which are required in large amount for body are known as macronutrients.

Examples: Carbon, oxygen, calcium etc. **ii. Micronutrients:**

The nutrients which are required in large amount for body are known as macronutrients.

Example: Zinc, sodium, Boron etc.

Importance of nutrients:

- It constitutes a source of energy for organisms.
- It provides a building material for growth and development. ➢ It regulates various body functions.

Q3. Explain the role of minerals elements in plants life?

Ans: Plants require mineral elements for various activities and structures. These required nutrients are categorized into two groups. **Macronutrients:**

The elements which are required by plants in larger quantities are called macronutrients. These are nine in numbers.

Micronutrients:

The minerals elements which are required in lower quantities are called micronutrients. These are eight in numbers.

Note:

If any one of these is not supplied plants display abnormalities of growth and do not reproduce normally.

Role of Mineral elements in plants life:

	Mineral elements	Role in plant life

Macronutrient	Carbon	Form the backbone of many plant biomolecules
	Hydrogen	Necessary for cellular respiration
	Oxygen	Component of ATP nucleic acids and coenzymes
	Phosphorus	Necessary for seed germination, photosynthesis, protein formation etc.
	Potassium	Regulates the opening and closing of the stomata reduces water loss from the leaves
	Nitrogen	Component of proteins, hormones, chlorophyll, vitamins and Enzymes
	Sulphur	Component of proteins vitamins
	Calcium	Activates enzymes is a structural component of cell wall influences water movement in cells
	Magnesium	Component of chlorophyll activates many enzymes.

	Mineral elements	**Role in plant life**
Micronutrient	Iron	Necessary for Photosynthesis, activates many enzymes
	Molybdenum	Component of the enzymes that reduces nitrates to ammonia important in building amino acids.
	Boron	Important in sugar transport, cell division and synthesizing certain Enzymes
	Copper	Component of several enzymes
	Manganese	Involved in enzyme activity for photosynthesis, respiration and nitrogen metabolism.
	Zinc	Required in a large number of enzymes
	Chlorine	Involved in osmosis of water
	Nickel	Required in nitrogen metabolism

Q4: Write the Role and Deficiency symptoms of Nitrogen and Magnesium? Ans:

Nitrogen Source:

Plants obtain nitrogen in the form of nitrate and Ammonia from the decay of dead Animals **Role:**

- Nitrogen is the basic component of proteins, vitamins, hormones, chlorophyll and enzymes essential for plants life.
- Nitrogen helps in the growth of stem and leaf.
- Carnivorous plants have evolved mechanisms for trapping and digesting small animals. The products of this digestion provide Nitrogen for these plants.

Deficiency:

- Too much nitrogen can delay flowering and fruiting.
- Deficiency of nitrogen can reduce yields, causing yellowing of the leaves and stunt growth.

Magnesium Source:

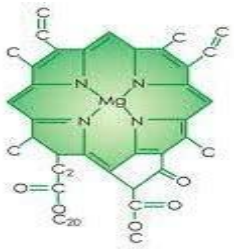
Plants absorb magnesium in the form of Mg^{+2} ions from the soil.

Role:

- Magnesium is the central part of chlorophyll molecule.
- It used for fruit, seed and not formation.
- It is necessary for functioning of plant enzymes to produce carbohydrates sugars and fats.
- It is essential for germination of seeds.

Deficiency:

- Deficiency of magnesium causes chlorosis (yellowing of leaves).
- Its deficiency may affect normal rate of metabolism and ultimately lead to necrosis (cell death).



Plant Chlorophyll

Q5. What are fertilizers in how many groups they are classified, also write its importance?

Ans: Fertilizers:

Fertilizers are materials applied to plants for result of desirable characteristics. Such as more fruits, faster growth better colour and more flowers etc.

Classification:

They are classified as organic and inorganic fertilizers. **I.**

Organic fertilizers:

- They are derived either from plant or animal source.
- Fertilizer obtained from animal source include manure, compost etc.
- Plants materials called mulch are also organic fertilizer example are hay, leaves, barks, wood chips, seed hulls and corn husks.

Advantages of organic fertilizers:

- Improve the soil structure.
- Retain soil moisture.
- Release nutrients slowly and consistently.

- Mobilize existing soil nutrients
- Make the soil permeable for absorption of water and nutrients movement inside the soil.

ii. Inorganic fertilizers:

- Inorganic fertilizers are also called chemical fertilizers.
- Mostly they are formed from chemical compounds such as ammonium nitrate (NH_4NO_3), Ammonium phosphate $(NH_4)_3PO_4$, Potassium Chloride (KCL_3), Sodium Nitrate ($NaN0_3$) etc.
- They dissolve readily in water and immediately available to plants for uptake.
- Examples are sodium nitrate, mined rock, phosphate and limestone.

Advantages of inorganic fertilizers.

- It promotes protein synthesis.
- It also increases chlorophyll synthesis
- It increases the growth of stem and leaves
- High amount of phosphorus result in healthier roots and more flowers.

Q6: Enlist environmental hazards related to use of chemical fertilizers.

Ans: Environmental hazards related to use of fertilizers are:

i. Increasing the salinity and acidity of soil.

ii. The quantities of fertilizers affect the soil nutrients holding capacity. iii. Some nitrogen fertilizer may cause emission of the greenhouse gases (nitrogen oxide). iv. NO^{-3} leaching into drinking water cause cancer and other health problems.

v. Its high solubility also causes eutrophication (increase algal growth on the surface of water) and cause the death of aquatic organisms like fish etc.

vi. Bad smell form manure affects air quality. vii. Increase the pathogens which cause diseases in human and animals.

Q7. Define carbohydrate and its types?

Ans: Meaning:

- Carbo mean carbon
- Hydrates mean water. **Definition:**

Carbohydrates are organic compounds mainly composed of carbon, hydrogen and oxygen.

OR

Carbohydrates are ply hydroxyl derivatives of aldehyde and ketones.

Explanation:

The ratio of hydrogen and oxygen in water is 2:1. Thus the ratio of Hydrogen and oxygen in carbohydrate is equal to the ratio of H and O in water. Therefore, carbohydrate is commonly called hydrated carbon. **Sources:**

Major sources of carbohydrates are rice, sugar honey, potato, bread and cereal etc. **General formula:**

General formula is $(CH_2O)_n$ where "n" stands for number. **Classification:**

i. Monosaccharide's e.g., glucose, fructose, galactose

ii. Disaccharides / oligosaccharides e.g., maltose, sucrose. iii. Polysaccharides e.g. starch, glycogen.

Function of carbohydrates: i.

Source of energy:

Carbohydrates provide energy during cellular respiration. About 2/3 of the total calories every animal consume daily are from carbohydrates. One gram of carbohydrates produces about four kilocalories of energy. **ii. Building materials:**

In plants cell wall is composed of cellulose which is polysaccharide **iii.**

Storage molecules:

Excess of glucose in plant is converted into starch. While in animals' surplus glucose is stored in liver in the form of glycogen.

Q8. Write note on protein?

Ans: Protein:

Meaning:

The word protein is derived from Greek word proteios means "substance of first importance".

Building blocks:

The building blocks of proteins are Amino-acid. There are over twenty different types of amino acid.

General formula of Amino Acid:

- -COOH is called carboxyl group. • $-H_2N$ is called Amino group
- "R" Alkyl group.

Peptide bond:

In protein amino acids are linked through peptide bonds.

Sources:

i. **Plant sources:** beans, pulses, cereals and dry fruits.

ii. **Animals' source:** milk poultry, fish, meat. **Shape;**

Proteins may be fibrous e-g keratin in hairs or may be globular e.g., haemoglobin.

Importance of Proteins: i.

Source of energy:

Protein acts as a source of energy. One gram of protein provides 1 kilo calories of energy. **ii.**

Building materials:

Protein makes body parts such as muscles, tendons, hairs, nails, hoof etc. **iii.**

Essential components:

Protein is an essential component of cell membrane, cytoplasm and organelles.

iv. Source of chemical components: Source of antibiotics, enzymes, hormone

Source of proteins:

Plant Source: Beans, Pulses and fruits.

Animal Source: Cheese, Milk, Poultry, fish meat.

Q9. Write a comprehensive note on fats?

Ans: Fats (Lipid):

Fats belong to a group of organic compounds called lipid. They are made up of fatty acid and glycerol. They contain carbon, hydrogen and oxygen.

Sources:

Butter, Oil, cheese, Meat, Dry Fruits, milk, ghee, egg yolk etc. **Characteristics of fats:**

i. They may be liquid or solid at room temperature. ii. Fats serve both structural and metabolic function. iii. Fats are stored in the cells of adipose tissue. iv. They cannot be prepared by body and obtained from food sources.

Function of Fats:

i.Source of energy:

Fats are source of energy. One gram of fats provides 9 kilo calories of energy.

ii. **Building materials:**

Essential component of cell membrane and also maintain healthy skin and hair.

iii. **insulation:**

Fats insulate the body organs against shock and also maintain body temperature. **iv.**

Others:

Fats help in digestion, transport of vitamins A,D,E and K in the body.

Q10. Define vitamins and its types?

Vitamins:

Organic substances which are essential in small amount for the regulation of normal functioning of the bodies.

Types on the basis of solubility: i.

Water soluble vitamins:

Vitamins B and C are water soluble vitamins they cannot stay as much in our body. **ii.**

Fats soluble vitamins:

Vitamins A,D,E,K are fats soluble vitamins. Fat soluble vitamins stay for a few days while some for six months and can use them when needed.

Q11. Write the sources, importance and deficiency symptoms of vitamin A, and vitamin D?

Ans: Vitamin "A":

It is fat soluble vitamin.

Chemical name:

The chemical name is retinol because it helps in the functions of the retina of eye. **Sources:**

Animal Sources: Chicken liver, code live oil, eggs, butter cheese etc.

Plant Sources: sweet potato, carrots, pumpkins, spinach etc….

Metabolic Role:

i. It helps to see in dim light.

ii. It is involved in normal cell differentiation. iii. It supports reproductive process and bone growth. iv. It is essential for body immune function. **Deficiency symptoms:**

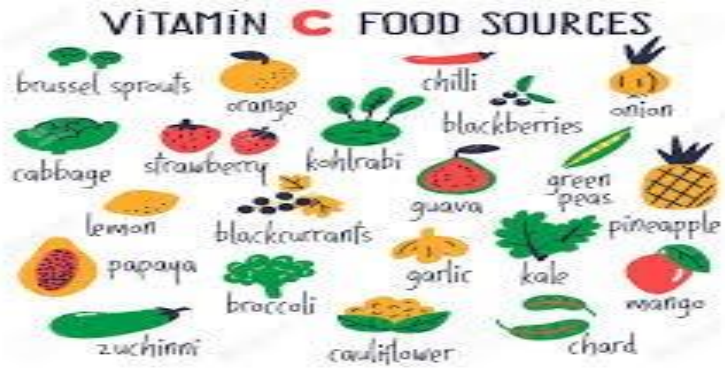
i. Deficiency causes night blindness.

ii. Decreases the immune power of the body. iii. Its deficiency also causes rough and dry texture to skin.

iv. The attack of viral disease will be increases. e.g. measles and chickenpox etc.

Vitamin "C":

It is water soluble vitamin.



Chemical name:

It is also called Ascorbic Acid.

Source:

Orange, lemon, graphs, leafy vegetables, beef liver, tomato, strawberries and Guava etc.

Metabolic Role:

i. Vitamin "C" is needed for the growth and repair of tissues in all parts of the body.

ii. Vitamin "C" is essential for healing of wound.

iii. It is also essential for maintaining bones and teeth.

iv. It blocks the damage caused by free radicals. This causes cancer, heart diseases, Aging and Arthritis.

v. Vitamin C in WBC,s enables the immune system to function properly.

Deficiency symptoms:

i. Bleeding of gums. ii. Nose bleeding. iii. Inflammation of the gum (gingivitis).

iv. Dry and splitting hairs

v. Dry and scaly skin vi. Decrease wound healing rate. vi. High blood pressure, stroke, cancer.

Vitamin "D":

It is also fats soluble vitamins

Chemical Name:

Calciferol **Sources:**

Egg yolk, liver oil, cheese, fortified bread, fortified margarine. It is also synthesis by skin when UV radiations from sun are used to convert cholesterol derivatives into vitamin D.

Metabolic Role:

if. Vitamin "D" helps in the absorption of calcium and phosphorous.

ii. Vitamin "D" helps to regulate blood level of calcium and phosphorous. iii. It helps in the normal function of muscles and nerves. iv. It keeps the bones strong.

Deficiency symptoms:

i. Long term deficiency of Vitamin "D" affects the bones. ii. In children vitamin "D" deficiency leads to rickets. iii. Rickets is a condition in which bones become weak and bow under pressure. iv. In adults vitamin "D" deficiency causes osteomalacia or soft bones. v. increasing the risk for fractures in bones.

Q 12: Define minerals? Enlist some minerals needed for our body.

Ans: Minerals:

Mineral are inorganic elements that originate in the earth and cannot be made in the body.

Source:

Most of the mineral in the human diet come directly from the plants and water, or indirectly from animal's source.

Types:

Mineral are categories into major minerals and trace minerals. **i.**

Major minerals:

Those minerals that are required in the amount of 100 mg or more per day are called major minerals e.g. sodium, potassium, chloride, calcium, magnesium, phosphorous and Sulphur. **ii.**

Trace minerals:

Those minerals that require in amounts less than 100mg per day.e.g. fe, zinc, Cu, Cr, ,I, Mg and Mo.

Importance:

Minerals both major and trace play vital roles in human health like.

- Sodium, potassium and chloride are important for muscle contraction, nerve impulse transmission, heart function and blood pressure.
- Calcium and phosphorous help in the development and maintenance of bones and teeth.
- Iodine essential for normal thyroid function.
- Iron is the central component of haemoglobin that transport oxygen in blood.

Q13: Write the sources Role and deficiency symptoms of calcium.

Ans: Calcium:

It is one of the most important and abundant minerals in human body. About 99% of the body calcium is stored in bone tissue. The remaining 1 % of the body calcium circulates in the blood and other body fluid. **Source:**

Daily products like milk and cheese are the major source of calcium. Other source is egg yolk, beans, nuts, cabbage etc. **Metabolic Role of calcium:**

i. Calcium is essential for the development and maintenance of bones.

ii. It is also essential for teeth formation. iii. It play important role in blood clotting. iv. It also play role in the transmission of nerve impulses, muscle contraction and other metabolic activities.

v. It is also needed for Activation of several enzymes. **Deficiency symptoms:**

i. Nails become brittle and skin becomes dry. ii. Muscles cramps and eyes twitching occur. iii. Its deficiency also causes rickets osteoporosis. iv. Bones also becomes soft. v. Wounds heal slowly.

Q14: Write the sources, Role and Deficiency symptoms of iron? Ans:

Iron:

It is also an important major type of mineral.

Sources:

Red meat, fish, bens, dried fruits, green vegetables and apple.

Metabolic Role of Iron:

i. Iron helps in transportation and storing of oxygen.

ii. it is the component of haemoglobin in red blood cells and myoglobin in muscle cells. iii. Cellular energy also requires iron which act as enzyme cofactor. vi. It also supports immune system.

Deficiency symptoms:

i. Its deficiency cause anemia (decrease in the amount of RBCs or haemoglobin in the blood).

ii. The patient feels fatigue, weakness and rapid heartbeat.

Q15: What is dietary fiber? Discuss the role of dietary fiber in balance diet.

Ans: Dietary fiber:

It is also known as "roughage" or "bulk". It is the part of human food that is indigestible. Dietary fiber found only in plant food and it moves undigested through the stomach and small intestine and then into the colon.

Types:

There are two types of dietary fibers. **i.**

Soluble dietary fiber:

Soluble dietary fibers break down as it passes through the digestive tract, forming a gel.

Source: Oat, bean, and barley. **ii. Insoluble dietary fiber:**

Insoluble fiber do not dissolve in water and travels through small intestine quickly.

Source: Wheat bran, whole grain seed, cereal, skin of many fruits and vegetables.

Role of Dietary fibers:

i. It prevents and relieves constipation and reduces the risk of hemorrhoids (Swollen anal tissue). ii. It controls weight by creating feeling of fullness. iii. It takes some acids away in the stool. iv. It lowers blood cholesterol level. v. It also lowers blood sugar level. vi. Insoluble fibers minimize exposure to carcinogens. vii. It also speeds up the passage of food through the gut. viii. Increasing stool bulk and making stools softer and easier to pass.

Q 16: Write the importance of water?

Ans: Water is the most abundant substance in human body. Our body contain about 70% water.

Source:

Daily water intake such as natural water, milk, juicy, fruits and vegetables.

Importance of water:

i. Water is the best solvent and generally called universal solvent. It dissolves many substances like sugar, salts etc. ii. It helps in the transport of material across the cell membrane. iii. Minerals are transported from roots to leaves through water. iv. it provides hydrogen for making glucose during photosynthesis.

v. Water regulated body temperature. It absorbs and release heat very slowly.

vi. It helps in the removal of nitrogenous waste and toxic materials from the body.

vii. Water acts as a reactant in many metabolic reactions e.g. in hydrolysis reaction.

viii. Water also acts as a lubricating medium. It is the major part of mucous and another lubricating medium. It is the major part of mucous and other lubricating fluids.

Q17: Define balance diet? Write its importance.

Ans: Balance diet:

A balanced diet may be defined as

"The diets which contain all the essential nutrients like carbohydrates, fats, protein, mineral, vitamin and fiber in the correct proportions for the normal growth and development of the body is called balanced diet"

OR

The diet which contains all the necessary components of food in correct proportion is called balanced diet.

Explanation:

The balance diet is must for balance activity of life such as growth, health, reproduction. If any component is missing then the body will suffer from many health abnormalities like kwashiorkor, marasmus and Goiter etc. Therefore, balance diet maintains health, growth and reproduction etc.

Example:
If there is not enough protein in our diet, we will not be able to grow properly and to repair ourselves i.e., wounds will not heal properly.

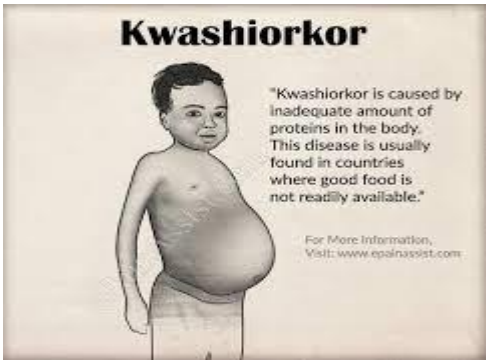
Diet and energy requirements:
Diet and energy requirements are always related to age, gender and activity of individual. **i. Relationship of energy requirement with age:**
An adult needs less food per kg of their body weight, but a growing boy or girl needs more food per kg weight. Children need more calcium and iron for their growing bones and red blood cells respectively.

ii. Relationship of energy requirement with gender:
Gender has an impact on the requirements of a balanced diet. Women have comparatively less metabolic rate than the men of the same age and weight. Men need a balanced diet that provides comparatively more energy than the women require. **iii. Relationships of energy requirement with activity:**
People have different lifestyle and varied nature of work. A man with sedentary habit does not require as much energy as the man who remains physically active for most of the day.

Recommended daily requirements of Carbohydrates, Proteins and Fats for adults.

	Percentage of daily diet	Male (80 Kg) Sedentary	Male (80kg) Active	Female (65kg) sedentary	Female (65kg) Active
Carbohydrates	45-65%	264-382g	344-500g	215-310g	280-404g
Proteins	10-15%	58-88g	76-115g	48-72g	62-93g
Fats	20-35%	54-95g	70-123g	44-77g	57-100g

Q18: Define Malnutrition. Discuss the types of malnutrition?
Ans: Malnutrition:
A diet which is missing in one or more essential nutrient cause malnutrition.
The condition caused by an improper or insufficient diet is called malnutrition.
Explanation:
Most commonly malnourished people either do not have enough calories in their diet, or eating a diet that lacks protein, vitamin or trace element.
Types:
Malnutrition may be in the form of
i. Protein energy malnutrition (PEM) ii. Mineral deficiency disease (MDD) iii. Over intake of nutrients (OIN) **1. Protein energy malnutrition. (PEM):**
The terms protein-energy malnutrition applies to a condition in which the body is not getting required amounts of proteins or any energy producing nutrients (carbohydrates, lipids and proteins). Two important diseases associated with PEM are marasmus and kwashiorkor.

	Marasmus	**Kwashiorkor**
i	It occurs in children due to very low intake of carbohydrates, proteins and fats.	It occurs in children or adults due to inadequate intake of proteins.
ii	Marasmus occurs in children below the age of one year	Kwashiorkor occurs in children or the age of 1-5 years.
iii	This disease is more common in town and cities where breast feeding is Discontinued quite early.	This disease is more common in villages where there are small gap period b/w Successive pregnancies.
iv	No swelling of body take place	Swelling of body occur due to retention of fluid.
v	Wasting of muscles is quite evident	Wasting of muscles is not evident
vi	Skin does not change colour and do not break.	Skin change colour and become broken and scaly
vii	It can be treated by adding all nutrients to the diet. 	It can be treated by adding proteins to the diet. 

2. Mineral Deficiency diseases (MDD):

When the concentration of minerals is less than normal amount. It causes mineral deficiency diseases. Minerals deficiencies lead to variety of disease such as: i. Anemia ii. Beriberi iii. Osteoporosis iv. Goiter **i. Anemia:**

Anemia is the most common of all mineral deficiency disease. The term anemia literally means "a lack of blood". The condition is caused when the number of red blood cells is reduced to level lower than the normal.

Symptoms:

The common symptoms of anemia are constant fatigue and weakness, prolonged anemia results in hair loss, brittle hair and nail.

Treatment:

It can be treated by using diet containing proper amount of iron, folate and vitamin B_{12}. **ii. Osteoporosis:**

Meaning:

- Osteo men bone
- Porous mean pore.

Definition:

The disorder of bones in which the bones become thin, soft, reduces in mass, start bending and can easily be broken.

Cause:

It is caused due to the deficiency of calcium or vitamin D in blood.

Symptoms:

In this disease the bones become porous and light.

Treatment:

It is treated by taking calcium rich food such as milk, butter, egg yolk or by using calcium dose and taking regular exercise. **iii. Goiter:**

Goiter is a condition caused by an insufficient amount of iodine in the diet. Iodine is used by the thyroid gland to produce hormone that control the body normal growth. If sufficient iodine is not available in a person's diet the thyroid gland becomes enlarged and it result swelling in the neck. This condition is known as goiter.

3. Over intake of Nutrients:

Over intake of nutrients is a form of malnutrition in which more nutrients are taken than the amount required for normal growth, development and metabolism

Over intake of nutrients cause a number of health problems. **i.**

Obesity:

- It occurs due to over intake of carbohydrates and fats.
- Obesity is also known as mother of diseases.
- Obese people may suffer from hypertension, liver, renal and heart disorder.

ii. Hypervitaminosis"D":

- It causes due to over intake of Vitamins "D".
- Over intake of Vitamin "D" also causes nausea. Fatigue, vomiting and renal disorder etc.

iii. Hypervitaminosis "A":

- It is caused due to over intake of Vitamin "A".
- It leads to dry itchy skin. Painful swelling of legs and hands, enlargement of spleen etc.

Q19:What are the causes of malnutrition:

Ans: Causes of malnutrition:

i. Malnutrition occurs due to lack of knowledge about proper and balance diet. ii. It causes due to poor absorption of food from the GIT (Gastro intestinal tract). iii.It cause due to problems of economy especially in underdeveloped countries. iv.Famines also cause malnutrition. (Famine is the lack of enough food to feed all the people living in an area)

Q20: Define digestion, ingestion, absorption, assimilation, egestion?

Ans: Digestion:

The break down of large, complex, non diffusible and insoluble food into small, simple, diffusible and soluble form by the action of enzyme is called digestion.

Ingestion:

Taking in of food in oral cavity is called ingestion.

Absorption:

The movement of soluble and diffusible food from the digestive tract into the blood is called absorption.

Assimilation:

It is the process in which digested food becomes part of a cell.

Egestion:

The removal of undigested food from the body is called egestion.

Q21. Describe the structure of human digestive system in detail?

Ans: Structure of human digestive system:

Human digestive system consists of the following two parts

i. Alimentary Canal. ii. Associated glands. **i. Alimentary canal:**

Definition:

A long coiled tube extending from mouth to the anus is known as alimentary canal.

Other names:

It also knows by the following names:

- Gastro intestinal tract.
- Digestive tract.

Part of alimentary canal:

Alimentary canal consists of following parts.

i. Oral cavity (Buccal cavity) ii. Pharynx iii. Esophagus

iv. Stomach

v. Small intestine vi. Large intestine

i. Oral cavity:

Oral cavity is the first part of the alimentary canal which receives the food.

Parts:

It consists of the three important organs.

a. Teeth
b. Tongue
c. Salivary glands.

a.Teeth:

The teeth of mammals are specialized to perform particular function.

Function:

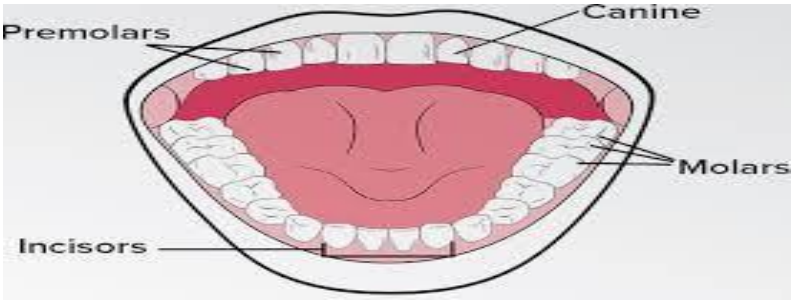
Teeth are used for cutting, biting and grinding of food.

Type of teeth;

It has the following main types and has following functions.

- Incisor teeth adapted for cutting and biting.

- Canine teeth for tearing.
- Molar and premolar for grinding and mastication of food.



Tongue:

Tongue is the muscular organ containing taste buds.

Function:

- It lubricates the food to make bolus and help in swallowing process. ➢ It also helps in mixing of food.
- Taste bud help us to sense the taste of food. **D. Salivary gland:**

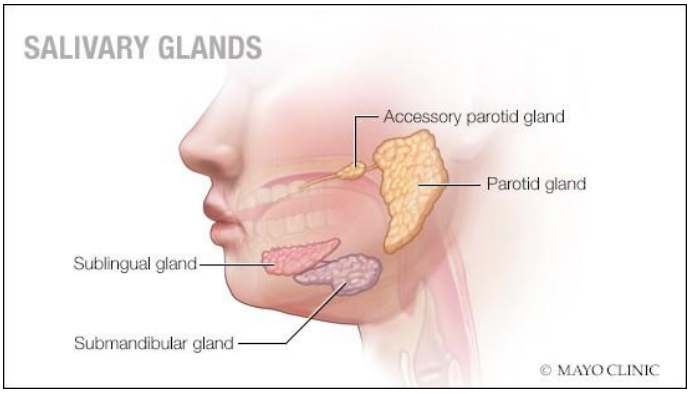
The glands present in oral cavity which secrete **Saliva** called salivary glands. There are three pair of salivary glands in oral cavity.

Saliva:

Composition:

It contains molecule of water, mucous, salt and other digestive enzymes.

- Mucus lubricates the food.
- Sodium bicarbonate ($NaHCO_3$) kills the germs and bacteria present in food.
- Salivary amylase enzyme helps in digestion of starch and glycogen. ➢ Maltase helps in conversion of maltose to glucose.



ii) Pharynx;

The oral cavity open into pharynx and the tongue pushes the food into pharynx.

Location: pharynx is present at the back of oral cavity.

Function: From pharynx, the food is passes to esophagus by a process called peristalsis.

iii. Oesophagus.

It is muscular tube, extending from pharynx into the stomach.

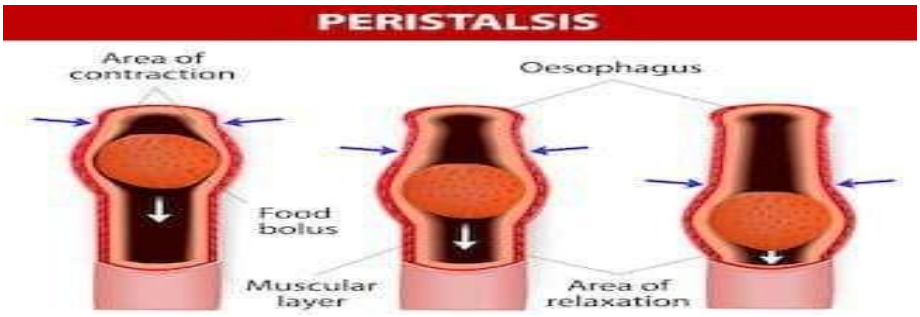
Size: Oesophagus is about 10-inch-long tube.

Location: it runs through the neck a thorax between the trachea and vertebral column.

While passing through oesophagus food experience one of the following processes.

a. Peristalsis:

It is the process by which food moves downward in forward direction by the alternate contraction and relaxation of the muscular wall of digestive tract.



b. Anti-peristalsis:

The opposite movement of foods (upwards) in digestive tract is called antiperistalsis. It causes vomiting. **iv. Stomach:**

Stomach is a sac like organ of the alimentary canal. **Location:**

It is located in abdominal cavity between the esophagus and intestine. **Size:**

It is about 12 inches long and 6 inches wide at the widest point.

Capacity:

The Capacity of stomach is 1 liter.

Sphincter:

It the opening of stomach guarded by muscles. Stomach has two sphincters **a)**

Pyloric Sphincter:

At the end of stomach pyloric sphincter is present which connect stomach with small intestine. **b)**

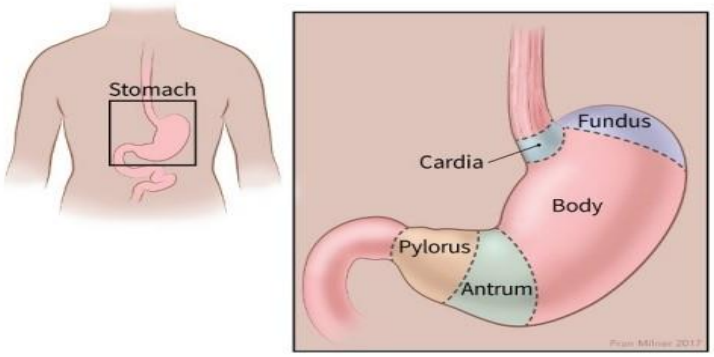
Cardiac sphincter:

It is present between esophagus and stomach.

Function of sphincter: Sphincter prevents the back movement of food.

Gastric gland:

The inner walls of the stomach have many glands called gastric glands. These glands secrete gastric juice.



Composition of gastric Juices:

Gastric juice is composed chiefly of mucous, hydrochloric acid and pepsinogen.

- Mucous forms a coating on the inner walls of stomach. It protects the inner lining or stomach from HCL and enzymatic action of pepsin.
- Pepsinogen is inactive form of enzyme. It is converted to its active form pepsin by the action of HCl.
- Pepsin partially digests the protein portion of the food into peptide chains.
- The digested food forms a thick soap like fluid knows as acidic chyme. This process occurs in two to four hours and then passes the chyme to small intestine in 20 to 30 minutes.

V) Small intestine:

Stomach opens into small intestine. Small intestine is elongated and narrow coiled tube. It has three main parts.

i. **Duodenum (**associated glands)

ii. **Jejunum** **iii. Ileum**

i. Duodenum:

- It is the first part of small intestine.
- It is about 12 inches long and curved like "C".
- It receives chyme from the stomach.
- In duodenum, the chyme receives the bile form the liver and pancreatic juice from the pancreases.

Two important associated glands open to duodenum are,

a. **Liver**
b. **Pancreas**

a. Liver:

Colour: It is large reddish-brown gland.

Largest gland: it is the largest gland of the human body.

Weight: In adult human its weight is about 1.5kg.

Position: It lies beneath the diaphragm on the right side of the abdomen.

Lobes: It consist of two main lobes the right larger and the left smaller lobe.

Gall bladder: It is pear shaped greenish yellow sac that lies along the right lobe of liver on the ventral side.

Function: Gall bladder store and concentrates the bile.

Secretion of liver:

Liver secrete bile which is stored in gall bladder when the gall bladder contracts the bile is released into the duodenum through the bile duct. **Bile:**

Bile is a green alkaline fluid without any enzyme. The bile contains water, sodium carbonate excess of calcium and the breakdown products of haemoglobin.

Role of liver in digestion:

- Bile breaks larger fats into smaller droplets. This process is called emulsification. ➢ It converts ammonia to a less toxic form urea.
- Formation of red blood cells in fetus.
- Convert carbohydrates and proteins into fats.
- Stores fat soluble vitamins (A,D,E,K)
- Manufacture blood clotting protein fibrinogen.
- In cold temperature liver carries out basic metabolism at faster rate and so produce heat. ➢ Liver makes vitamin A from carotene.

b. Pancreas: Pancreas is a leaf like gland.

Position:

It lies beneath the stomach.

Colour: It is yellowish in colour.

Size: It is 7 inch long 1.5 inch wide.

Secretion: Pancreas secretes pancreatic juice. Pancreatic juice contains sodium bicarbonate and enzymes. Sodium bicarbonate neutralize he acidity of chyme while enzyme consist of three types. These enzymes are

a. Trypsinogen
b. Pancreatic Amylase
c. Lipase

a. Trypsinogen:

It is inactive form of enzyme. It is converted to active form by the action of enterokinase. The Active form is called trypsin. Trypsin helps in digestion of proteins. **b. Pancreatic Amylase:**

The pancreatic Amylase converts starch into simple form called maltose. **C.**

Lipase: Lipase convert fats into fatty Acid and glycerol.

ii. Jejunum:

It is the second part of the small intestine and comes after duodenum. It secretes intestinal juice to perform the breakdown of food. It is about 2.4m long. **iii. ileum.**

It is the last part of small intestine and about 2.6m long. The gland of ileum secretes intestinal Juice which contains many enzymes such as erepsin, Maltase, sucrase and lactase.

a. **Erepsin:** It converts protein into amino acids.
b. **Maltase:** It converts maltose into glucose.
c. **Sucrase:** It converts sucrose into glucose and fructose.
d. **Lactase:** It converts lactose into glucose and galactose.

Absorption of food:

After the complete digestion of food amino acid, simple sugar, glycerol and fatty acids are absorbed from the small intestine into blood capillaries present in villi.

Villi:

The inner lining of small intestine has many folds. These folds have millions of fingers like projections called villi. The outer epithelium of each villus is made of a single layer of cells.

Microvilli:

The epithelium of villi also contains microscopic projections called microvilli.

The microvilli greatly increase the surface area of the villus. Inside villus, there are blood capillaries and a small lymphatic vessel called lacteal. During absorption, the simple sugar, amino acids vitamins, minerals and water enter the blood capillaries in villi. These capillaries open in hepatic portal vein which carries nutrients to the liver. Fatty acid and glycerol are absorbed into the lacteal which pour them into the blood stream.

vi) Large intestine:

Large intestine is the last organ of digestive system where undigested food is collected and converted into faces. The large intestine in about 1.5m long and consists of caecum, appendix, colon and rectum. **i. Caecum:**

It is the first part of the large intestine. It is the junction between small intestine and colon. It collects and stored materials from small intestine and move materials toward the colon. **ii. Appendix:**

It is finger like projection arising from the caecum in human body. Its function is unknown while in animals it digests cellulose. The inflammation of appendix is called appendicitis that remove through surgery. **iii. Colon:**

It is the longest part of large intestine and like inverted "U" shape.

Parts: It consist of following four parts.

a) **Descending colon:**
This colon goes down ward on the left-hand side of the abdomen.

b) **Transverse colon:**
Transverse mean across, this part of the colon extends across the abdomen from right to left.

c) **Ascending colon:**
Starts at the caecum at the bottom right hand side of the abdomen and ascend towards the liver.

d) **Sigmoid colon:**
It is located on the bottom left hand side of the abdomen. It is s-shape connection between the descending colon and the rectum.

iv. Rectum:

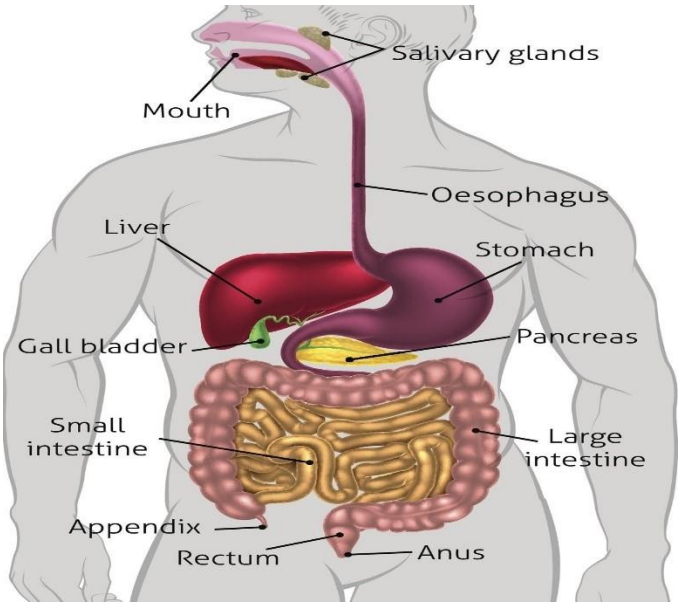
It is the last part of the large intestine that stored undigested food. It opens into the anus which removes the faeces from the body called egestion.

Function of large intestine:

i. Reabsorbs water and maintains the fluid balance of the body.

ii. Absorb certain vitamins. **iii.** Processes undigested materials (fiber) **iv.** Store wasted products before it eliminated.

v.Many bacteria live in colon. They produce vitamin "K" which is necessary for the coagulation of blood.



Q22: Discuss some disorder of gut?

Ans: Disorder of Gut:

Any defect occur in the digestive system is called disorder of gut. Some common disorders of digestive system are, **i. Constipation ii. Diarrhea iii. Ulcers**

i. Constipation:

The condition in which the faeces become dry, hard, defecation occur irregularly and difficulty is known as constipation.

Symptoms:

- Passing hard or dry stools three times a week or less than three times a weak.
- Unusual staining at stool.
- Abdominal bloating or discomfort.
- It causes depression and headache.
- It also causes inflammation of blood vessel at the anus.

Cause:

- Frequent use of spicy food.
- Insufficient fluid intake.
- Less intake of vegetables and dietary fiber.
- Excessive use of food stuff that tends to create dryness of mucus membrane.

Treatment:

- Constipation is treated by taking more dietary fiber and water along with diet. ➢ Laxative medicines are also used to treat constipation.

Prevention:

- Increase your intake of liquid.
- Eating fibrous food like cereals, vegetable and fruits.
- Don't use laxative unnecessarily.

ii. Diarrhea:

Diarrhea is condition in which the sufferer has frequent watery stool.

Symptoms:

- Diarrhea cause dehydration and loss of minerals which lead to kidney failure.
- It causes weakness and disturbs the contraction of muscle (heart muscles) due to imbalance of salt in the blood.
- A person with diarrhea typically passes stool more than three times per days.
- Abdominal pain, nausea and vomiting.

Causes:

Diarrhea is usually related to a bacterial, viral or parasite infection e.g. bacteria including salmonella and Escherichia coli. Parasite like Entamoeba histolytic, virus like retrovirus.

Treatment:

- It is treated by consuming adequate amounts of water preferably mixed with salts and nutrients to replace the loss.
- When diarrhea is due to bacterial infection, it is treated by administration of antibiotics.

Prevention:

- Water should be boiled before using.
- Unhygienic food and water should not be consumed.
- Fruit juice, soft fruit and vegetable that contain potassium help restore electrolyte levels.

iii. Ulcers:

The inner wall of the digestive tract (stomach + duodenum) is covered with mucous to protect it from enzyme. When the mucus breakdown and the digestive enzyme eats away the wall of stomach or duodenum which results in sore called ulcers. **Types:**

There are two types of ulcer. **i.**

Gastric ulcer:

Ulcer that occurs in stomach is called gastric ulcer. **ii.**

Duodenal ulcer:

Ulcer that occurs in first part of the small intestine beyond the stomach is called duodenal ulcer.

Symptoms:

- Burn feeling in stomach that last between 30 minutes and hours. ➢ The patient feels stomach pain, abdominal pain, blood in faeces.
- Appetite and weight loss are other symptoms.

Cause:

The main cause of the breakdown of the mucosa layer are bacteria, drugs cigarette smoking long term use of anti-inflammatory medicine (like aspirin) and prolong tension.

Prevention:

- Smoking, drinking alcohol, coffee tea and stress should be avoided.
- Also avoiding spicy and acidic food.

SHORT QUESTIONS

b. Give short answers to the following questions.

Q1: List all parts (in order) of the human digestive system through which food actually passes?

Ans: i. Oral cavity.
ii. Pharynx,
iii. Oesophagus
iv. Stomach
v. Small intestine (Duodenum, Jejunum, ileum).
vi. Large intestine, rectum, anus.

Q2: How is food mechanically broken-down during digestion?

Ans: The physical breakdown of food into small pieces is called mechanical digestion. Mechanical digestion starts from oral cavity.

- Teeth help in grinding, cutting, biting and mastication of food.
- Tongue help in chewing of food.
- Also, during peristalsis breakdown of food occur.
- In stomach by contraction and relaxation of smooth muscles the food is converted into acidic chyme and then passes into small intestine.

Q3: How does the digestion and absorption of fats differ from the digestion and absorption of carbohydrates and protein? Ans: Digestion and absorption of fats:

- Bile is secreted form liver that acts on fats which is broken down into water soluble fats (emulsification)
- Digestion of fats occurs in duodenum through lipase enzyme
- After digestion fatty acid and glycerol are the end products of fats that absorbed into the lacteal and join the blood stream.

Digestion and absorption of Proteins:

- Digestion of proteins occur in stomach by pepsin enzyme
- Pancreatic juice contains trypsin that acts on proteins and converts it into dipeptides and amino acids.
- Absorption of amino acid occurs in small intestine by villi.

Digestion and absorption of carbohydrates:

- Digestion of proteins occur in stomach by pepsin enzyme
- Pancreatic juice contains trypsin that acts on proteins and converts it into dipeptides and amino acids.
- Absorption of amino acid occurs in small intestine by villi.

Digestion and absorption of carbohydrates:

- Salivary glands secrete saliva that contains amylase which digests starch.
- Pancreatic juice contains amylase that converts sugar into glucose.
- Digested carbohydrates than absorbed in small intestine (villi).

Q4: Enlist five environmental hazards related to the use of fertilizer?

Ans: See Q No. 6

Q5: What is malnutrition? Why it is considered to be a health hazard?

Ans: Lack of proper nutrition is called malnutrition. It may be due to ➢ Not having enough food to eat.

- Not eating enough of the right things.
- Unable to use the food eaten.

Malnutrition is considered to be a health hazard because it leads to serious health problems. Malnutrition may be in the form of

i. PEM (Protein energy malnutrition) e.g., marasmus, Kwashiorkor. **ii.** MDD(mineral deficiency disease) e.g. anemia, beriberi, goiter.

iii. OIN (over intake of nutrients) e.g., obesity, hypertension.

Q5: Discuss the role of dietary fibers in balanced diets?

Ans: Role of Dietary fibers:

i. It prevents and relieves constipation and reduces the risk of pile.

ii. It controls weight by creating feeling of fullness. **iii.** It takes some acid away in the stool. **iv.** It lowers the cholesterol level in blood. **v.** It also lowers the sugar level in blood.

Long Question

C. Give detailed Answers to the following Question.

Q1: Overtake of nutrition can lead to serious health disorders. Evaluate the statement by gibe example?

Ans: See Q No. 18.

Q2: List down major enzymes in human digestive system. Elaborate their role in digestion?

Ans: The enzymes which help in the digestion of food are called digestive enzymes. Some of the enzymes in human digestive system are: **i. Salivary amylase/ptyalin:**

Saliva contains enzyme like “amylase” that converts starch into maltose. **ii. Maltase:**

Saliva also contains maltase which converts maltose into glucose.

Maltose ⟶ **glucose +**

glucose iii. Pepsinogen:

Gastric Juice of stomach contains pepsinogen. Pepsinogen change into pepsin by HCL which converts protein into peptide. **iv. Pancreatic amylase:**

The pancreatic juice of pancreas secretes "Pancreatic amylase" that convert starch into maltose. **v. Trypsinogen:**

Pancreas also secrets trypsinogen which converts into trypsin by duodenal enzyme. Trypsin converts protein into peptide and amino acids. **vi. Lipase:**

Pancreas also secretes lipase. Lipase act on emulsified fats and convert into fatty acid and glycerol.

vii. Duodenal enzyme:

Small intestine also secretes some enzyme. These are,

- **Erepsin:** Erepsin convert peptide into amino acid.
- **Maltase:** Maltase convert maltose into glucose.
- **Sucrase:** Convert sucrose into glucose and fructose.
- **Lactase:** Convert lactose into glucose and galactose.

Q3: Explain the importance of water in the human body.

Ans: See Q No. 16

Q4: Explain the role of oral cavity and pharynx in the digestive system. Ans:

See Q No. 21

Q5: Describe the structure of a villus, including the roles of capillaries and lacteals? Ans:

See Q No. 21

Chapter No.9 Transport

Q1. What is transport?

Ans: Transport:

Definition:

The movement of substances into and out of the body or cells of an organism is called transport.

i. Transport in unicellular and simple multicellular organism:

There is no special transport system or organs in unicellular organisms and less complex multicellular organism. Because their size is very small and the whole body of the organism is in contact with surrounding. So, in these organism transports occur directly through diffusion and osmosis. **ii. Transport in multicellular organisms:**

The cells of multicellular organisms are far apart from the environment. Therefore, there exists a proper system for the transport of materials.

Example:

Transport in animals take place by blood circulatory system.

Transport in higher plants take place by vascular systems. i.e. xylem and phloem **Xylem:**

Transport water and dissolved minerals from root to plant body.

Phloem: Transport prepared food from leaves to other part of the plant body.

Importance:

Each and every cell of the body needs food and oxygen and also needs to remove the waste products; it produced during its metabolic activities.

Q2. Describe transport in plants?

Ans: Transport:

Definition:

The movement of substance into and out of the body or cells of an organism is called transport.

Transport in lower plants:

Lower plants like bryophytes and mosses have direct contact with water. These cells absorb water directly by diffusion therefore they have no proper system for the transport of materials.

Transport in Higher plants:

Higher plants anchored in the soil and can transport many substances that needed for their growth like water and minerals for metabolism, Co_2 for photosynthesis, O_2 for respiration.

- Water and dissolved salts are transported from the roots to the shoot through the xylem tissue.
- Prepared food from leaves is transported to all parts of the body through phloem.

Absorption of water and salt:

Water is a best solvent and medium of transport. It dissolves many substances like minerals and salt. Root absorbs water from the soil by the process of diffusion. **a. Root hairs:**

Root hairs provide large surface area for absorption. They grow out into the space between soil particles where they are in direct contact with the water. The cytoplasm of the root hairs has higher concentration of salts than the soil water. So, water move by osmosis into the root hairs. **b. Epidermis:**

From the root hairs, water goes by osmosis to the other cells of epidermis. **c. Cortex:**

From epidermis, salts and water move to the cortex of root. It is present just below the epidermis.

d. Endodermis:

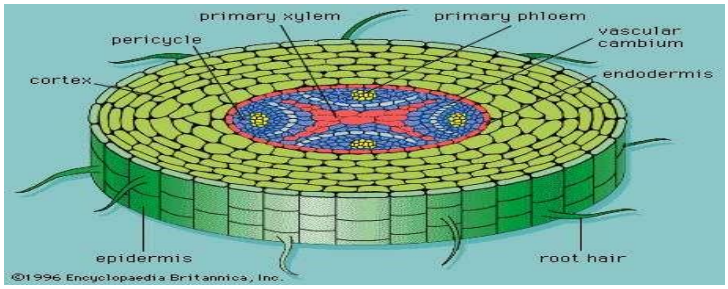
The innermost boundary of the cortex is the endodermis. **e.**

Pericycle:

The water and salts move to a narrow layer of cells called pericycle. **f.**

Xylem:

After crossing the pericycle, water and salts enter in xylem tissue. This water is carried by xylem to all other parts of the plants body.



Q3: What is transpiration? Discuss transpiration from leaves?

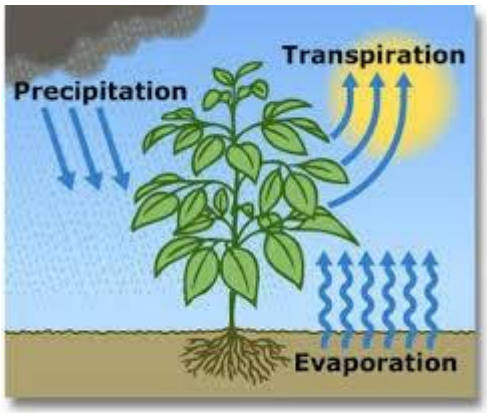
Ans: Transpiration:

Definition:

The loss of water in the form of water vapours from aerial parts of plant body is called Transpiration. This loss may occur:

- Through Stomata in leaves
- Through cuticle present on leaf epidermis
- Through special openings called lenticels present in the stems of some plants.

Transportation occurs manly through the special openings present in leaf epidermis. These opening are called stomata. About 90% transpiration occur through stomata. In leaves, water is present in xylem tissues. This water moves to the cell walls of mesophyll cells. From the moist walls of mesophyll cells, water evaporates into the air spaces of the leaf. These water vapours then move towards the stomata and pass into the outside air.



Q4: Discuss the stomatal control of transpiration?

Ans: Transpiration:

Definition:

The loss of water in the form of water vapours form aerial parts of plant body is called transpiration.

Stomatal transpiration:

Transpiration occur through stomata in leaves is called stomatal transpiration. Mainly transpiration takes place through stomata. About 90% transpiration occur through stomata.

Structure of stomata:

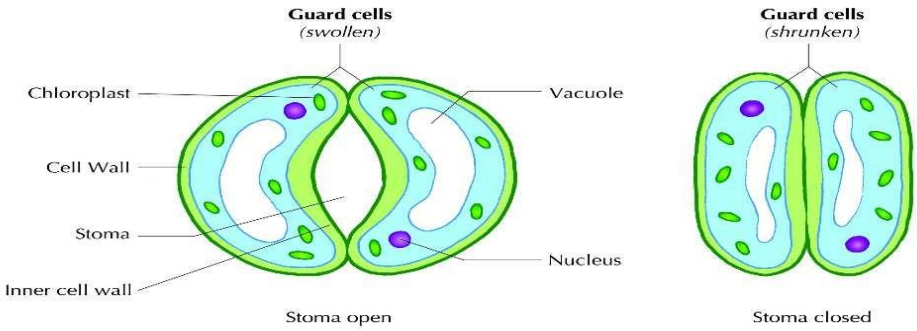
The two guard cells of a stoma are attached to each other at their ends. Guard cells are the only epidermal cells which contains chloroplasts.

Opening of stomata:

During day time, guard cells do photosynthesis and prepare glucose. So, the solute concentration remains high in guard cells. therefore, water move in them and they become turgid and stomata become open. When there is sufficient water in the soil. Stomata remain open for transpiration. **Closing of stomata:**

At evening the glucose concentration in guard cells fall down. This is because no photosynthesis occurs in night. Due to this, water also moves from guard cells and these cells loss turgidity. Their inner side touches each other and the stoma closes.

When there is deficiency of water in the soil, stomata start closing and decrease in the rate of transpiration occurs.



Q5. What the factors that affecting the rate of transpiration?

Ans: Factors affecting on transpiration:

The rate of transpiration depends on many factors. Some of the important factors and their effects are as follow. **i. Light:**

Light has direct effect on the opening and closing of stomata. In strong light, stomata are open and rate of transpiration become high. In cloudy weather or in dim light, the rate of transpiration becomes slow while in darkness they are completely stops. **ii. Temperature:**

The rate of transpiration increases with the increase in temperature. The rate of transpiration becomes double for every 10C^{o} rise in temperature up to 30C^{o}. Above 30C^{o} the stomata start closing and at 45C^{o} the stomata completely closed and the transpiration becomes stops.

iii. Humidity:

The presence of water vapours in air is called humidity. The rate of transpiration is inversely proportional to the humidity. Increase in humidity decrease the rate of transpiration while decrease in humidity increases the rate of transpiration. **iv. Soil moisture:**

If more water is present in the soil more absorption will take place through the roots and rate of transpiration will increase. **v. Wind:**

Wind (air in motion) carries the evaporated water from leaves and it causes an increase in the rate of evaporation from the surface of mesophyll. When air is still, the rate of transpiration is reduced. **vi. Number and distribution of stomata:**

The rate of transpiration also depends upon the surface area of leaf. More surface area provides more stomata and there is more transpiration. In most land plants, the number of stomata is greater on the lower leaf surface than on the upper surface. Therefore, more transpiration occurs from the lower surface.

Q6. Write the significance of transpiration?

Ans: Significance of transpiration:

i. Transpiration is a vital process in the life of plants.

ii. Due to transpiration, the mesophyll cells always remain moist. This helps in gaseous exchange. iii. Transpiration prevents the leaves from overheating and keeps them cool. iv. It helps in the absorption of water from roots. v. It helps in the upward movement of water.

vi. It eliminates the extra water. vii. It produces water column from roots to leaves by transpiration pull.

viii. It keeps balance the water level in plants.

Q7: Transpiration is a necessary evil-discuss?

Ans: Transpiration is very useful to plants. But it is also harmful in some Aspects. Transpiration is considered to be a necessary evil due to the following reasons.

i.Loss of water from plants causes wilting in hot summer season and sometimes even plants die.

ii. The shortage of water reduces the growth and the yield of crops like rice maize, whet. Therefore, it affects the economy of nation. **iii.** Transpiration in higher plants causes the reduction of water level in the soil. As a result, the water table goes down and tube wells become dry out. **iv.** Deep tube wells are used for irrigation purposes it costs too much. This is also an economic loss.

Q8: Discuss the transportation of water in plant body?

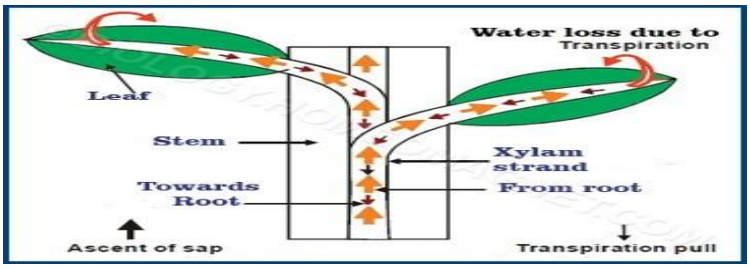
Ans: The Transportation of water in plant body is explained by Cohesion tension theory. According to this theory "The mechanism by which water (along with dissolved material) is carried upward through the xylem is called transpiration pull. **Transpiration pull:**

The suction force which pulls water up in the xylem tissue is called transpiration pull.

Mechanism:

When the cells of leaves lose water, a force called suction force is generated which pull water from the xylem vessels of leaf which turn take water from branches xylem and branches xylem from stem xylem. Xylem vessels of stem pull water from root xylem and the root take water from the soil. This upward movement of water produces a column from roots to leaves is called transpiration stream. This unbroken water column is mainly due to three reasons; ➢ The attractive forces among molecule.

- ➢ Narrow diameter of xylem vessels.
- ➢ The forces by which water molecules are adhere to the wall of the xylem vessels.



Q9: What do you know about the translocation of organic solutes in plants. OR What is the mechanism of translocation of food? OR How does the pressure flow theory explain the movement of sugars through phloem vessels of a plant?

Ans: When the food is prepared in green leaves by photosynthesis. The green leaves are called "Source of Assimilates" or simply "Source".

This food is transported by phloem to the other parts like branches, roots, seed and fruits called "sink of assimilates" of simply "sink". So, translocation may be defined as "The transport of food from the source to sink is called translocation of food".

Many different theories were presented by different scientists about translocation of food. But the most acceptable theory is pressure flow theory.

Pressure Flow theory:

This theory was proposed by a German biologist Ernst Munch in 1930.

Statement:

According to this theory, the movement of dissolve food molecules occurs from source to sink.

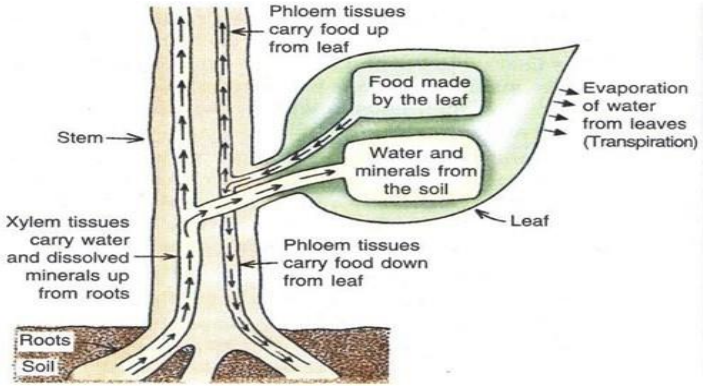
Step of translocation:

i. At the source site, food (sucrose) enters the sieve tubes of phloem by active transport. Companion cells of phloem provided ATP energy for this transport.

ii. High solute concentration in sieve tubes absorbs water from nearby xylem tissue osmosis.

iii. Due to the movement of water the turgor pressure in sieve tube increases and the solution of food start flowing toward the sink. iv. At the sink, food is actively removed from sieve tubes.

v. In this way the turgor pressure in sieve tubes fall down causing a flow of mass from the higher pressure at the source to the lower pressure at the sink.



Q10: Describe the composition of blood also write the function of blood?

Ans: Blood:

Blood is a red fluid which circulates through blood vessels and heart. Blood is a type of connective tissue and is composed of liquid plasma and blood cells.

- pH of human blood is 7.4.

- The weight of blood is about 1/12th of our body.
- The average adult has 5 liters blood.

Composition of Blood:

a) Plasma b) Blood Cells

a) Plasma:

Plasma is the liquid portion of blood. About 55% of blood consists of blood plasma.

Composition of Plasma:

Water	=	90%
Protein	=	7%
Sugar	=	0.1%
Inorganic salt	=	0.9%

Waste product, waste materials and hormone = 2%.

Function:

i. Plasma keeps all the tissue moist.

ii. Plasma of the blood transports nutrients, water, slats, hormones and waste materials. **iii.** Plasma helps in regulating body temperature. **iv.** Small amounts of oxygen are also carried by plasma.

v. Most of Co_2 is transported by plasma.

vi. Plasma proteins e.g. albumins maintain the osmotic pressure of blood. **vii.** Important plasma proteins called antibodies defend the body against pathogens.

viii. Another plasma protein fibrinogen is responsible for blood clotting. **b)**

Blood Cells:

Blood cells constitute 45% volume of blood.

There are three types of blood cells.

a) Red blood cell(erythrocytes)
b) White blood cells(leukocytes)
c) Platelets (thrombocytes).

a) Red Blood cells (erythrocytes) Shape:

The mature red blood cells are rounded or biconcave in shape.

Number:

One cubic millimeter of blood contains 5 million RBCs.

Size:

The Average diameter of erythrocytes is 0.8 micrometre.

Formation of RBC,s:

In the embryonic stage, RBC,s is formed in liver and spleen. In adults they are formed in the red bone marrows of short bone such as sternum, ribs and vertebrae. **Structure of red blood cells:**

Mammalian RBC,s when formed have nucleus, mitochondria, endoplasmic reticulum and other cell organelles but these lost with maturation. About 95% of RBC,s are composed of hemoglobinand5% is of enzymes, slates and other proteins.

Haemoglobin:

RBC,s contains red pigment called haemoglobin.

Average life span of RBC,s:

The average life span of RBC,s is about 120 days.

Destruction:

RBC,s are destroyed in spleen and liver. About 2.5 million of RBC,s are destroyed at every second in the body.

Function:

It transports oxygen form lungs to all parts of the body.

2. White blood cells (Leucocytes):

Shape:

White blood cells are colourless and are nucleated blood cell. They are irregular in shape.

Size:

They are large than RBC,s. There are 1 or 2 leukocytes for every 1000 RBC,s.

Number of white blood cells:

One cubic millimeter of blood contains 7000 to 8000 white blood cells.

Average life span:

The life span is very short form 7 hours to maximum of 3 days.

Types: There are three main types of WBC,s. The two main types are further divided into five types.

1. Granulocytes;

Granulocytes are the leukocytes which have granular cytoplasm.

Granulocytes include

i. Neutrophils ii. Eosinophils iii. Basophils **2.**

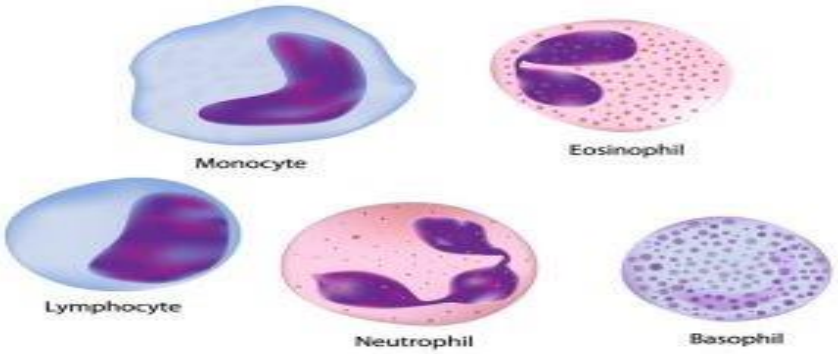
Agranulocytes:

They have clear cytoplasm. They include

i. Lymphocytes ii. Monocytes

Function:

- These blood cells are the part of immune system and defend our body against disease.
- They circulates and transport to an area where infection has developed.
- Some WBC kills pathogens like bacteria and virus.
- Some of them also produce inflammation at the site of infection. ➢ Some WBC makes antibodies against infectious particles.



3. Platelets (Thrombocytes):

Platelets are not rue cells because these are the fragments of large cell of bone marrow called megakaryocytes. They do not have any nucleus.

Shape:

These are spindle in shape.

Colour:

These are colourless because they have no pigment.

Number:

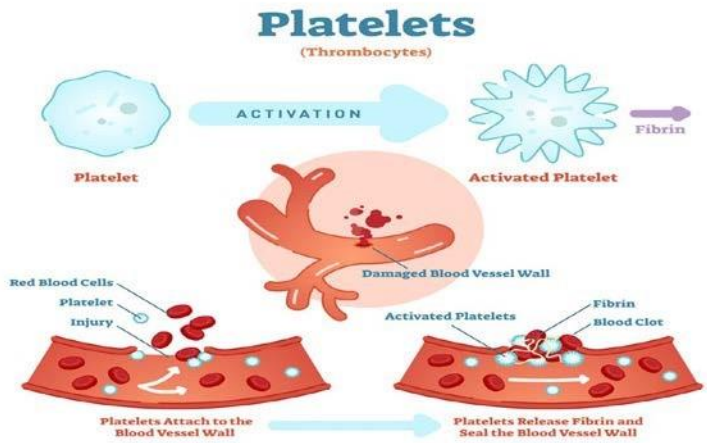
One cubic millimeter of blood contains 15,000 to 450,000 platelets.

Life span:

Their average life span is about 7 to 12 days.

Function of platelets:

Platelets help in blood clotting. When a blood vessel rupture, the blood start oozing out. Platelets gather around the site of infection and release substance which convert plasma protein into insoluble form fibrin. Fibrin makes a mesh in which platelets and other blood cells are entangled. Thus, a clot is formed which stop the blood flow from the wound.



Q11: Discuss disorder of blood.

1. Leukemia (Leukos – White, haema-blood):

It is also called blood cancer.

Cause:

In this disease the number of WBCs increase abnormality and start engulfing (eating) of RBC and Platelets.

Symptoms:

The abnormal cells also attack on bone marrows therefore the bones become soft, fragile and sever pain is produced in bones. A leukemia person suffers in severe Anemia.

Treatment:

- Transplantation of bone marrow but it is very expensive.
- Regular blood transfusion is required to save the life of Leukemic person.

2. Thalassemia (thalasa mean sea, haema mean blood)**:**

This disease was originally found in those people which living on the shore of Mediterranean sea.

Cause:

It is a genetically transmitted disease transfer from parents to offspring. A person with thalassemia has a defective gene for production of haemoglobin.

Symptoms:

Server anemia, enlargement of spleen.

Treatment:

The blood is regularly replaced with normal blood.

Q12: Define Antigen and antibody?

Ans: Antigen:

Any substance which start the production of antibody is called antigen.

Example:

Germ or any other foreign substance or toxic are different antigens.

Antibody:

The response of WBC,s to produces a specialized type of protein against antigen to kill and destroyed them called antibody.

Q13: How different blood groups are formed. What is the practical implication in the blood transfusion?

Ans: ABO blood group system:

Discovery:

It was discovered by Karl land Steiner in 1901. Different types of blood groups are due to the specific antigen present on the surface of red blood cells. Which are antigen "A" and "B". **Blood group "A":**

A person have blood group A contain antigen "A" and antibodies "B". **Blood group "B":**

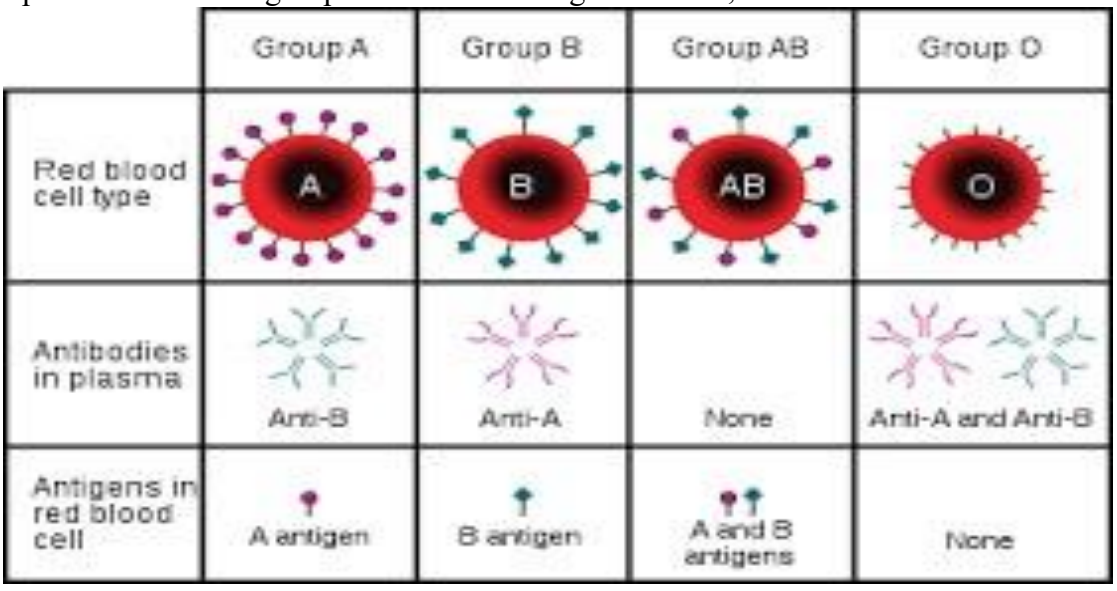
A person have blood group B contain antigen "B" and antibodies "A".

Blood group "AB":

A person have blood group AB contain both antigen "A" and "B" and have no antibodies.

Blood group "O"

A person have blood group O contain no antigen on RBC,s but have both antibodies A&B.



Q14: Discuss Blood Transfusion in ABO system?

Ans: Blood transfusion:

The transfer of blood from healthy person to a patient is called blood transfusion.

Practical implication of blood groups in blood transfusion:

Matching of blood is necessary during blood transfusion. In blood transfusion. A person have blood group "A" cannot donate blood to a person have blood group "B" because plasma of blood

group "A" contain antibody "B" and plasma of blood group "B" contain antibody "A". Due to transfusion of opposite blood group clumping occurs in blood cells which cannot pass in microscopic blood group B transfused with blood group A. Anti-A antibody present in in recipients' blood will coagulate with RBC, s having antigen A of donated blood.

Rh Blood group system:

Discovery:

This system was discovered by Karl Land Steiner in 1930's. This system is based on the presence and absence of an another antigen called Rh factor or Rh antigen (first discovered in Rhesus monkey) on RBC,s.

Positive or negative blood group:

In Rh factor present on RBC,s blood group will be positive. If Rh factor is absent on RBC,s the blood group will be negative.

Blood transfusion in Rh system:

Rh +ve blood group can be transfused to Rh+ve recipient because both have Rh antigen. Similarly Rh-ve blood group can be given to Rh-ve donors. If an Rh-ve person receive Rh+ve blood, he will get Rh antigen. His blood will produce anti-Rh antibodies against Rh antigens and it will result in coagulation. But an Rh+ve person can receive Rh-ve blood only if donors blood (Rh-negative) has never been exposed to Rh-antigen and does not contain any anti-Rh antibody. People who have AB+ve blood group are universal recipient and O-ve blood group are universal donors.

Recipient Blood group	Donor Blood group
A	A and O
B	B and O
AB	A,B,AB,O
O	O only
Rh^{+}	Rh^{+} , Rh^{-}
Rh^{-}	Rh^{-}

Q15: Describe the structure of human hart with the help of labeled diagram?

Ans: Human Heart:

Human heart is also called cardium. The word derived from Greek word cardiac mean heart.

Shapes:

It is conical in shape and muscular pumping organ.

Muscles of heart:

Heart is made of muscles called cardiac muscles. Cardiac muscles are involuntary and composed of branched cells each with a single nucleus. **Position:**

The heart is present in the chest cavity below the sternum between the ribs.

Membrane of heart:

The Heart is enclosed in a membrane called pericardium.

Pericardial Fluid:

Between the pericardium and the heart walls a fluid known as pericardial fluid is present. Pericardial fluid lubricates the heart during movement.

Chambers of heart:

Human heart has **Four** main chambers.

i. Right atrium ii. Left atrium iii. Right ventricle iv. Left ventricle

i. Right atrium/ Auricle:

Right auricle is small thin walled chamber. Right Auricles receives deoxygenated blood from the whole body by superior and inferior venacava. Superior venacava bring deoxygenated blood from upper parts of the body while inferior venacava bring deoxygenated blood from lower parts of the body. Right atrium forces the blood right by an aperture called right. Auricular-ventricular aperture guarded by tricuspid valve. **ii. Right ventricle:**

They are thick walled large chamber. The right ventricle receives the deoxygenated blood from right atrium and pumps it to lungs through pulmonary artery for oxygenation. The semi lunar valve present between the right ventricle and pulmonary artery prevent the back flow of blood from pulmonary artery to right ventricle. **iii. Left atrium:**

It is thin walled small chamber it receives oxygenated blood from lungs through pulmonary vein. Left atrium force the oxygenated blood to left ventricle by an aperture called left auricular ventricular aperture guarded by bicuspid valve of mitral valve. **iv. Left Ventricle:**

Left ventricles are thick than right ventricle. The left ventricle receives the oxygenated blood from the left atrium and pumps it into aorta for distribution to the whole body.

Pathway of blood circulation:

There are two pathways of blood circulation.

1. Pulmonary blood circulation.
2. Systemic blood circulation.

1. Pulmonary blood circulation:

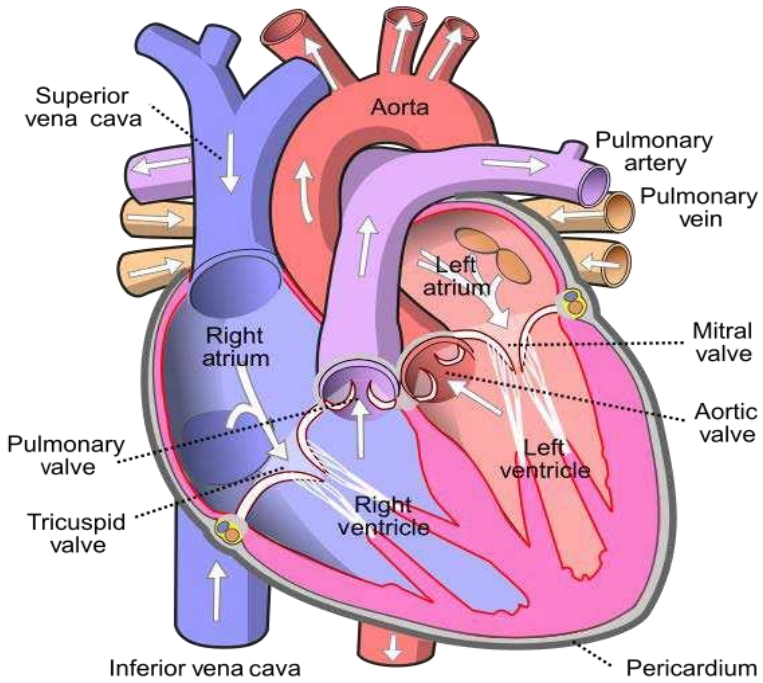
The pathway on which deoxygenated blood is carried from the heart to the lungs and in return oxygenated blood is carried from the lungs to the heart is called pulmonary blood circulation. Pulmonary blood circulation is carried out by two types of blood vessels.

a. Pulmonary artery: This artery transport deoxygenated blood from heart to lungs for oxygenation.

b. Pulmonary vein: This artery transport oxygenated blood from both lungs to heart.

2. Systemic blood circulation:

The pathway on which oxygenated blood is carried form heart to the body tissues and in return deoxygenated blood is carried from body tissue to the heat is called systemic circulation. In this circuit oxygenated blood is carried by aorta and deoxygenated blood is carried by vena cava. Pulmonary blood circulation pressure is low and systemic blood pressure is always greater.



Q16: What is cardiac cycle?

Ans: Each heart beat consisting of one systole and one diastole is called cardiac cycle. Contraction of heart is called systole while relaxation is called diastole. One cardiac cycle is completed in 0.8 seconds. Normal heart beat of healthy person is 72 beat per minute. This is also called heart rate. The complete cardiac cycle consists of following steps; **Cardiac diastole:**

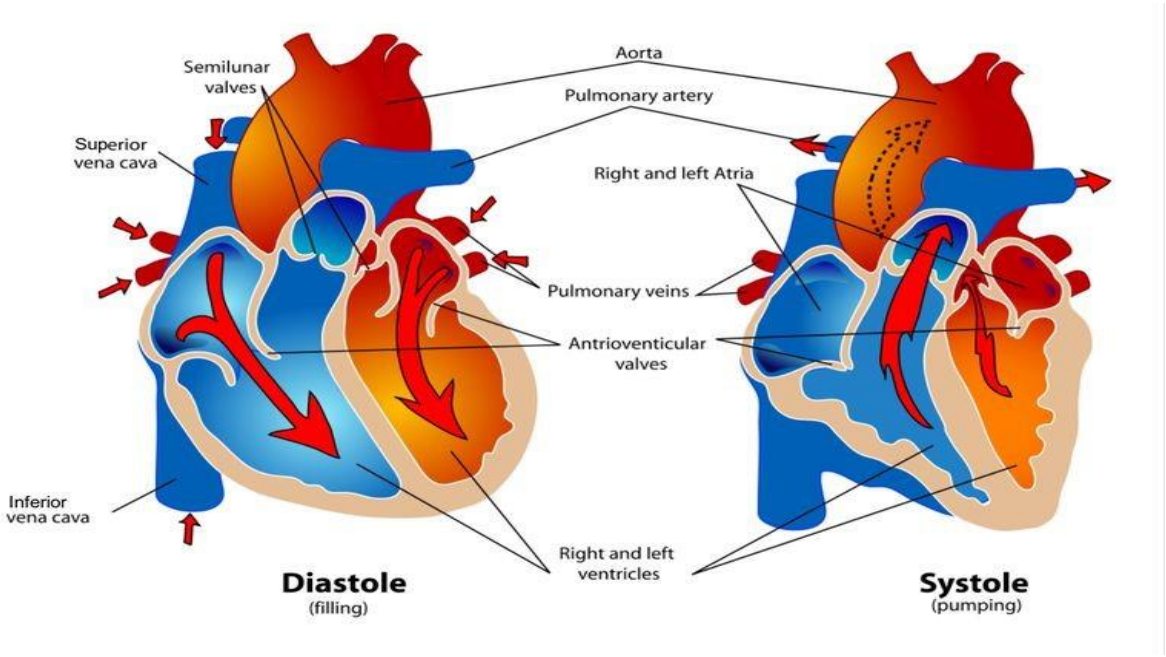
In cardiac diastole and auricle and ventricles relax and heart is filled with blood. During diastole "dubb" sound is produced due to the closing of semilunar valves. **Atrial Systole:**

Immediately after heart filling, both atria contract and pump the blood towards ventricles. This period in cardiac cycle is called atrial systole.

Ventricular systole:

When both ventricles contract and pump blood toward body and lungs is called ventricular systole. The period of ventricular contraction is about 0.3 seconds. During diastole "dub" sound is produced with the closing semi lunar valves.

Cardiac diastole = 0.4 seconds
Atrial systole = 0.1 seconds
Ventricle systole = 0.3 seconds



Q17: Write a note on pulse rate?

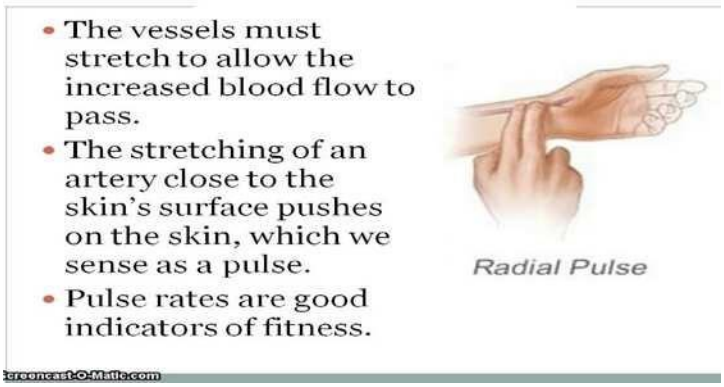
Ans: Pulse:

A pulse is a series of expansion waves in an artery cause by the contraction of left ventricle. When left ventricle contracts, it forces the blood into arteries. The elastic walls of arteries expand. The arteries in wrists are closed to the surface so pulse can be felt easily here.

Measurement:

The heart rate can be measured by feeling the pulse. The pulse can be felt at in area where the arteries are close to skin. For example, at the wrist, neck, groins or top of the foot. Most commonly people measure their pulse in their wrist.

Pulse rate is an easy way to understand the condition of heart because pulse rate is equal to heart rate. The average pulse rate is 72 times per minute.



Q 18: What are blood vessels? Describe the structure and function of various blood vessels?

Ans: Blood vessels:

Blood vessels are the part blood circulatory system that transports blood throughout the body. These vessels have internal hollow cavity called lumen.

Types:

Blood vessels are of three types.

i. Arteries ii.
Veins iii.
Capillaries

i. Arteries:

Those blood vessels which carry blood away from the heart toward body organs are called arteries. These blood vessel carry oxygenated blood from heart to various organs of the body except Pulmonary artery that carry deoxygenated blood to lungs for oxygenation.

Colour:

Arteries are bright red in colour due to the processes of oxygenated blood.

Structure of Arteries:

The wall of an artery is made of three layers.

i. Outer layer (tunica externa)
ii. Middle layer (tunica media) iii.
Inner layer (tunica interna)

i. Outer layer (tunica externa):

This layer allows arteries to expend and withstand high blood pressure. It is composed of connective tissue. **ii. Middle layer (tunica media):**

The middle layer of artery consists of circular smooth muscles and elastic tissue called tunica media. **iii. Inner layer (tunica interna):**

It is the innermost layer comparatively thinner than outer and middle layer and is made up of endothelial cells.

Aorta:

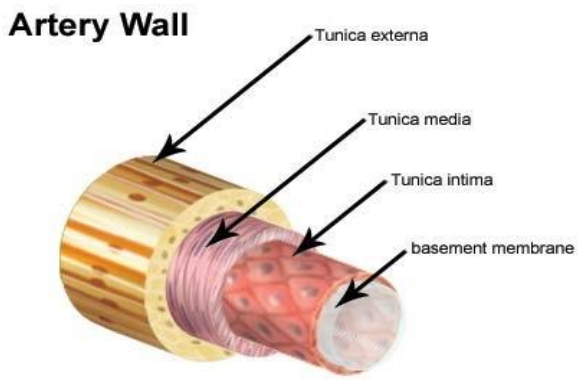
Aorta is the largest artery of the body which arises from the left ventricle. Many arteries arise from aorta. These arteries divide into smaller branches called arterioles and arterioles divide into capillaries. **2. Capillaries:**

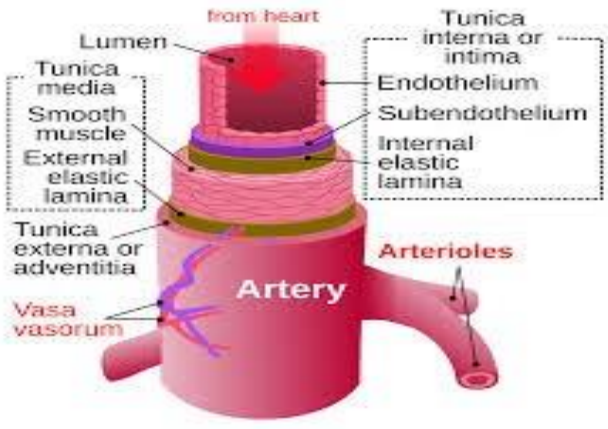
Capillaries are the smallest microscopic blood vessels that arise from arteries. Capillaries are so small that blood cells pass through them in a single file.

Wall:

The wall of capillaries are composed of only a single layer of cells called endothelium. There diameter is about 8 to 10 micrometre. **Function:**

The exchange of materials like water, oxygen, nutrients and waste products between cells and body fluid is carried out through capillaries.

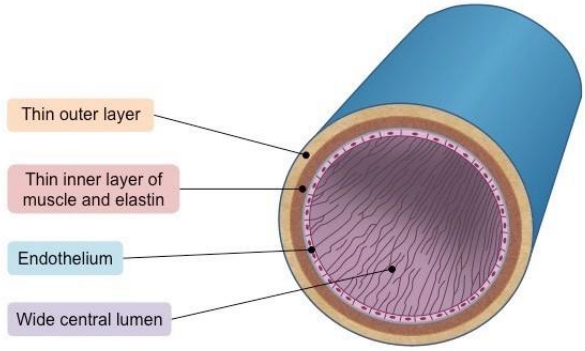




3) Veins;

Veins are the blood vessels that carry deoxygenated blood back form body organs to heart. Veins carry deoxygenated blood from all part of the body toward heart except pulmonary vein which carries oxygenated blood from lungs to heart.

Colour:
Veins are blue in colour due to the presence of deoxygenated blood.
Structure:
The wall of vein are made of three layers
i. Outer layer (tunica externa) ii. Middle layer (tunica media) iii. Inner layer (tunica interna) **i. Outer layer (tunica externa):** It is composed of connective tissue **ii. middle layer (tunica media):**
As compared to arteries they are thin. It has less smooth muscles and elastic tissue.
iii. Inner layer (tunica interna): It is the innermost layer of the vein.
Veins also have valves which allow the flow of blood in one direction i.e. Towards heart and prevent backward flow. The largest veins in the body are vena cave. Superior venacava bring deoxygenated blood from head and upper region of the body and inferior vana cava brings deoxygenated blood from lower part of the body.



Q19: Name major arteries and veins and discuss the organ to which they target?
Ans: The human circulatory system consists of two sub system. **i. Arterial system ii. Venous system**
i. Arterial system:
All the arteries make arterial system. Arteries carry blood away from heart to body organs.
Aorta:
Aorta is the largest artery of the body that arises from the left ventricle. All the other arteries arise from aorta.
a) Coronary artery:
They supply oxygenated blood and food to the muscles of the heart. **b.**
Carotid artery:
It run upward along trachea and supply oxygenated blood to head region. **c.**
Subclavian artery:
It supplies oxygenated blood to arms. **d.**
Coeliac artery:
It supplies oxygenated blood to the stomach and spleen. **e.**
Mesenteric artery:
It supplies oxygenated blood to the digestive organs like pancreas, duodenum and rectum etc. **f.**
Hepatic artery:
It supplies oxygenated blood to the liver. **g.**
Renal arteries;
It supplies oxygenated blood to the kidneys.

i. iliac arteries:
It supplies oxygenated blood to legs. **j.**
Pulmonary artery:
It supplies deoxygenated blood from heart to lungs for oxygenation.

2. Venous system:
All veins make the venous system. Veins brings deoxygenated blood from all part of the body back to heart.
Venacava:
These are the largest veins of the body. It consists, **a)**
Superior Vena Cava:
Superior vena cava is formed by the union of many pair of veins from head, shoulders and arms.
b) Inferior vena cava:
The inferior venacava is made of many veins from parts of the lower region of the body. All the other veins are connected with these two main veins. Other veins are, **a)Jugular vein:**
They bring deoxygenated blood from head region to heart. **b)**
Femoral vein:
It brings deoxygenated blood from legs region. **c)**
Subclavian vein:
They bring deoxygenated blood from arms and shoulder to heart. **d)**
Hepatic vein:
They bring deoxygenated blood from liver to heart. **e)**
Renal vein:
They bring deoxygenated blood from kidney to heart. **f)**
Celiac vein:
They bring deoxygenated blood from stomach and spleen to heart. **g)**
Mesenteric vein:
They bring deoxygenated blood from digestive organ like duodenum, pancreas, intestine and rectum etc to heart.
h) Pulmonary vein:
Pulmonary veins originate from lungs and bring oxygenated blood to left atrium.

Q20: Discuss the discovery of blood circulation?
Ans: Pioneers of discovering blood circulation Ibn-Al-Nafees and William Harvey. Many other names are also included in the list but the contribution of these two are high.
Ibn-Al-Nafees:
Introduction:
Ibn-Al-Nafees was born in 1210 A.D. He was a Muslim anatomist. He studied medicine at AlNouri and al-kabeer hospital in Damascus. In Cairo he took up medicine as a career.
Contribution:
- He was the first Muslim anatomist to explained pulmonary blood circulation in human beings. He discovered the central role of heart in the whole circulatory system.
- He explained the blood is purified in the lungs.

Date of Death:
He died in 1288 A.D.

William Harvey:
Introduction:
Harvey was born in 1578 A.D in Kent, England. He was an English physician.

Contribution:

- William Harvey was first scientist in the western world to describe correctly systemic circulation.
- He also describes the properties of blood.
- He demonstrate that heart and blood vessels form a continuous and closed system of circulation.

Date of Death:

Harvey was died in 1657.

Q21: Discuss cardiovascular disease?

Ans: Cardiovascular disease:

The diseases of heart and blood vessels are collectively called cardiovascular disorders. These diseases are one of the leading cause of death in the world. **i. Atherosclerosis(** Gr: athere-grout, sclerosis – harden):

The disease of the arteries occurs due to deposition of fatty materials (cholesterol) inside the arteries. In this disease the lumen of arteries reduces in size and may be completely blocked.

Effect on body:

- Decrease blood supply to the organs
- Hypoxia (lack of oxygen)
- Anginal pectoris **Causes:**
- Hypertension
- Smoking
- Diabetic mellitus.
- Increased lipid level.

Prevention:

- Using food with less cholesterol ➢ Avoid smoking
- To perform daily exercise.

Treatment:

- Coronary bypass surgery
- Placement of stent **ii) Arteriosclerosis(artere – artery, sclerosis- harden):**

Thickening and hardening of the wall of arteries is called arteriosclerosis. This occurs mainly due to deposition of calcium in the wall of arteries.

Effect on body:

This type of artery cannot expend during systole. This inflexibility of artery makes the heart to work harder.

Causes:

- Increasing age
- Sever atherosclerosis
- Increased calcium level in the blood

3. Myocardial infarction:

Myocardial infarction is also called heart attack. It occurs when a portion of heart muscle dies due to sudden reduction of blood supply to heart muscle. It mostly occurs in person over 45 year of age.

Causes:

- Hypertension
- Atherosclerosis
- Narrowing of coronary artery

- Increase demand of oxygen during exercise ➢ Excitement, fear and worry etc.

Symptoms:

- Chest pain
- Angina pectoris (moving pain in the left arm)
- Sweating
- Nausea
- Shortness of breath **Treatment:**
- **Angioplasty:** In this treatment a balloon tip catheter is passed in the artery. The balloon is inflated at the site of blockage which opens the artery.
- **Stent:** Some time a metallic ring is placed there at the site. The stent remain there as a part of artery.
- **Coronary bypass surgery:** In this treatment a vessel is taken from some other part of body and grafted from aorta to the coronary artery system.

Prevention:

- Use of balance diet.
- Regular exercise
- Regular medical check up
- Avoid smoking, stress and tension.

SHORT QUESTIONS

b. Give short answers to the following questions.

Q1: Why does a RBC lack cellular organelles?

Ans: RBC,s are specialized cells. 95% of their cytoplasm is composed of haemoglobin. The main function of RBC is to carry oxygen around the body. It has no nucleus and organelles so it can carry as much oxygen as possible. Absorption and release of oxygen by Hb is a spontaneous process and it does not need any kind of metabolic activity. Therefore RBC lack nucleus and other cellular organelles.

Q2: Is the rate of transpiration higher on a sunny day or a rainy day, why?

Ans: Light intensity and temperature accelerates the rate of transpiration while humidity slows down the rate of transpiration. So it shows that rate of transpiration will be higher on a sunny day than rainy day.

Q3: What will happen to transpiration stream if the air is injected in xylem vessels? Ans: The unbroken column of water which moves up in the xylem vessels is called transpiration stream. The entrance of air in the xylem is called air embolism if the air is injected in the xylem the column of water will break up and transpiration stream will stop.

Q4: What is translocation of food in plants?

Ans: See Q No. 9

Q5: What is transpiration pull? Describe the importance of transpiration in the life of the plant?

Ans: See Q No. 8

Q6: how does the pressure-flow theory explain the movement of sugars through phloem vessels of plant? Ans: See Q No. 9

Q7: Describe the composition of human blood. What are the main function of blood cells?

Ans: See Q No. 10

Q8: How are different blood groups formed. What is their practical implication in blood transfusion? Ans: See Q No.13

Q9: If we do not take water the whole day in the month of June, what would be the effect on volume of plasma in blood?

Ans: Blood plasma is composed of 90% of water. In the month of Junedue to high temperature sweating occur. Sweating causes loss of water from the blood plasma. So if we do not take water the whole day in the month of June. The volume of blood plasma will reduce and lead to dehydration.

Q10: Write any four differences between xylem and phloem? Ans:

Characteristics	**Xylem**	**Phloem**
Cell living/ Dead	Three dead cells (Vessel, tracheid's, xylem fiber) One living cell (xylem parenchyma)	One dead cell (phloem fiber) Three living cells (sieve tubes, companion cells and phloem parenchyma)
Cell wall thickness	Thick	Thin
Composition of cell wall	Lignin	Cellulose
Direction of flow	Upwards	Down and up
Cell wall permeability	Impermeable	Permeable

Long Question

C. Give detailed Answers to the following Question.

Q1: Draw the internal structure of a human heart and show the blood circulation with the help of arrows. Ans: See Q No. 15.

Q2: Discuss the function major arteries and veins.
Ans: See Q No. 19

Q3: Discuss transpiration and its importance.
Ans: See Q No. 3 & 6.

Q4: Can a person with blood type AB donate blood to a person with blood type A? Explain your answer?
Ans: A person having blood group AB cannot donate blood to a person having blood type A because plasma of blood group A contain antibody B. Blood group AB contain antigen A and B. Antibody B will attack on antigen B and antigen-antibody reaction will occur. As a result RBC,s will clump and the recipient can die of this effect.