

BIOLOGY

9th
CLASS



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In Medina there were many different tribes and sections of people the Holy Prophet Hazrat Muhammad (SAW) First abolished the tribal distinction because they knew that it was wrong.

Chapter No.1 Introduction to Biology

Q 1: Define Biology. Describe various branches of biology.

Ans: Word "Biology":

In 1736, Swedish Scientist Carl Linnaeus for the first time used the word 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 branch of natural science deals with the study of living organisms. (OR)

The study of life is called biology.

Main branches of Biology:-

There are three main branches of Biology.

1) **Botany:** The study of plants.

2) **Zoology:** The study of animals.

3) **Microbiology:** The study of microorganisms such as virus and bacteria etc.

Other branches of Biology:-

i. **Morphology (Morph : form):-**

The branch of biology 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 plant tissues is called histology.

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

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

v. **Embryology:-**

The branch of biology, 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 deals with the study of naming and classification of organism into groups and subgroups on the basis of similarities and differences is called taxonomy.

vii. Cell biology/Cytology:-

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

viii. Paleontology (Paleous- ancient; anta- beings):

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

Sub Branches of Paleontology:-

There are two sub branches of paleontology.

a) **Paleobotany** :-The study of Plants fossils.

b) **Paleozoology** :-The study of animals fossils.

ix.Immunology:-

The branch of biology which deals with the study of immune system of animals is called Immunology.

Immune system:-

The defense system of living organisms that fight against diseases causing microbes is called immune system.

x. Entomology (entomon-insect):-

The branch of biology which deals with the scientific study of insects is called entomology.

xi. Genetics:-

The branch of biology which deals with the study of heredity characters transmitted through genes from parents to the offspring is called genetics.

xii. Microbiology:-

The scientific study of microorganisms is called microbiology.

Microorganism:-

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

xiii. Biotechnology:-

The branch of biology deals with the study of the 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 interaction between organisms and their environment is called ecology. i.e 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 animals such as bees, ants and Migratory 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.

Q 2: Briefly establish the linkage between biology with Physics, Chemistry, Geography, Statistics 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 substances and processes that occur in living organisms is called Biochemistry.

Example:

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

III. Biogeography:-**Definition:-**

The study of distribution of various living organisms in different geographical regions of the world is called biogeography.

Explanation:

Scientist study of animal distribution to understand the spread of animal-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 statistics or mathematics to design, analyze and interpret the research data.

Example:-

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

V. Bio-economics:-**Definition:-**

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

Example:-

Production of new varieties of crops.

Q (3): Describe different careers paths 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 agriculture after higher secondary level.
- Agriculturists may work in the agriculture 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 (livestock) e.g cattle, sheep etc.
- Student of animal science can get degree in veterinary sciences after the higher secondary education in biology.
- Graduate in animals' science works 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 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 development 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 in 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 law enforcement agencies using scientific methods to discover and 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" all living organisms are classified into five kingdoms. In 1969 Robert Whittaker introduced this system. These five kingdom are,

i. Kingdom Monera (Prokaryotes- without nucleus):-

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 | → | Chlymadomonas. |
| 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 from chitin.
- They take their food by absorption (saprophyte).

Example:-

Bread mold, mushroom, puffballs and yeast etc.

iv. Kingdom Plantae:-

Characteristics:-

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

Examples:-

Wheat, Mango, Mulberry, Ferns, Pines etc.

v. 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, mammals etc.

Invertebrates:- They have no back bone e.g. insect, Ant, Jellyfish, worm 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 non-living things. Some of the Quranic verses in this regard are quoted below

i. خَلَقَ الْإِنْسَانَ مِنْ صَلْصَالٍ كَالْفَخَارِ

"Allah created man from sounding clay like the clay of pottery"
(Sura Rahman 55: Ayah 14)

ii. فَرَأَيْنَا الظُّفَرَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْفَكَةً فَخَلَقْنَا
الْمُضْفَكَةَ عَظِيمًا فَكَسَوْنَا الْعِظَمَةَ لَحْمًا ثُمَّ أَنْشَأْنَاهُ خَلْقًا آخَرَ
فَتَبَارَكَ اللَّهُ أَكْثَرُ الْخَلْقِينَ

"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 lump bones and clothed the bones with flesh then We developed out of it another creature so blessed Allah, the best to create".

(Sura Momioon 23: Ayah 14)

iii. وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ

"We made from water every living thing. Will they not then believe?"
(Sura Ambia 21: Ayah 30)

iv. وَفِي الْأَرْضِ قِطْعٌ مُتَجَوِّرٌ وَجَنَّتٌ مِنْ أَغْشَبٍ وَزَرْعٍ وَنَخْيلٌ
صَنَوَانٌ وَغَيْرُ صَنَوَانٍ يُسْقَى بِمَاءٍ وَاحِدٍ وَنَفَضِّلُ بَعْضَهَا عَلَى بَعْضٍ
فِي الْأَكْثَلٍ إِنَّ فِي ذَلِكَ لَذِكْرٌ لِقَوْمٍ يَعْقِلُونَ

"And in the earth are the tracts (diverse though) neighboring, 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 others to eat"

(Sura Al Ra'ad 13: Ayah 4)

v. فَرَأَيْنَا الظُّفَرَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْفَكَةً فَخَلَقْنَا
الْمُضْفَكَةَ عَظِيمًا فَكَسَوْنَا الْعِظَمَةَ لَحْمًا ثُمَّ أَنْشَأْنَاهُ خَلْقًا آخَرَ
فَتَبَارَكَ اللَّهُ أَكْثَرُ الْخَلْقِينَ

"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".

(Sura Nur 24: Ayah 45)

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 on plants and animals among these the important 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 Asmai:**

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 Asmai was regarded as the specialist of animal sciences.

Famous books: His famous books are as follows.

- **Al-Ibil:** 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: His valuable contribution was in the field of medicine. He is also known as father of medicines. He was an expert in mathematics, astronomy, physics and paleontology. He discovered 760 various types of drugs.

Famous Book:

His famous book "Al-Qanun-fil-tibb" is known as canon of medicine in west.

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 776 A.D.

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

Book: His famous book was Al-Haywan. In this book he described the characteristics of 350 species of animals especially about life of ants.

Date of Death: He died in 869 A.D.

v. Al-Farabi: (870-950 AD):

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

Contribution: He contributed in the field of Hikmat and biology. He was the renowned Hakim and biologist of the Islamic world.

Books: He wrote two well-known books,

- Kitab-ul-Nabat 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 diseases of eye in his books.

Date of Death: 1010 A.D.

ix.Ibn-Al-Nafees:

Date 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 levels 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 Sub-atomic level:-

All type of matter are 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.

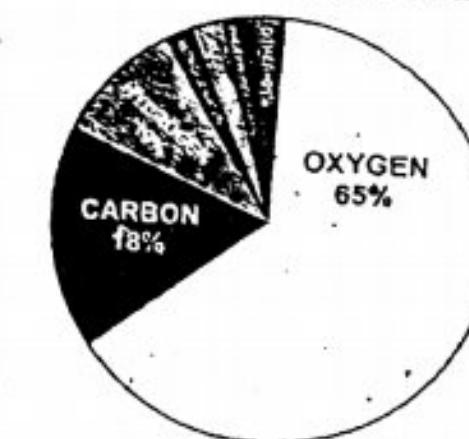
Sub atomic particles:-

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

- **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.

Bioelements:- Out of 92 natural occurring elements, 16 elements are called bio elements. These take part in making the body mass of a living organism. In these 16 bioelements, only six elements oxygen, carbon, Hydrogen , Nitrogen, calcium and Phosphorus make 99% of the total mass while other ten bio elements potassium, sulphur, chlorine, sodium, magnesium, iron, copper , manganese, zinc and iodine make 1% of the total mass.

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



II. Molecule level:**Definition:-**

A group of atoms bonded together is called molecule.

Examples are H_2 , N_2 , O_2 , etc.

I. Biomolecule:-**Definition:-**

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

Types of Biomolecules:-**a. Micro molecules:-**

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

Example:

Glucose, water, aminoacid etc.

b. Macro molecules:-

The molecules which have higher molecular weight.

Example:

Carbohydrates, proteins and lipid etc.

ii. Compounds:-**Definition:-**

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

Types:-**a-Organic compounds:-**

The compounds containing carbon, oxygen and hydrogen except CO , CO_2 , HCO_3 , CO_3 , CN , Carbide are called Organic compounds.

Example:

Carbohydrates, protein fats etc.

b. Inorganic compounds:-

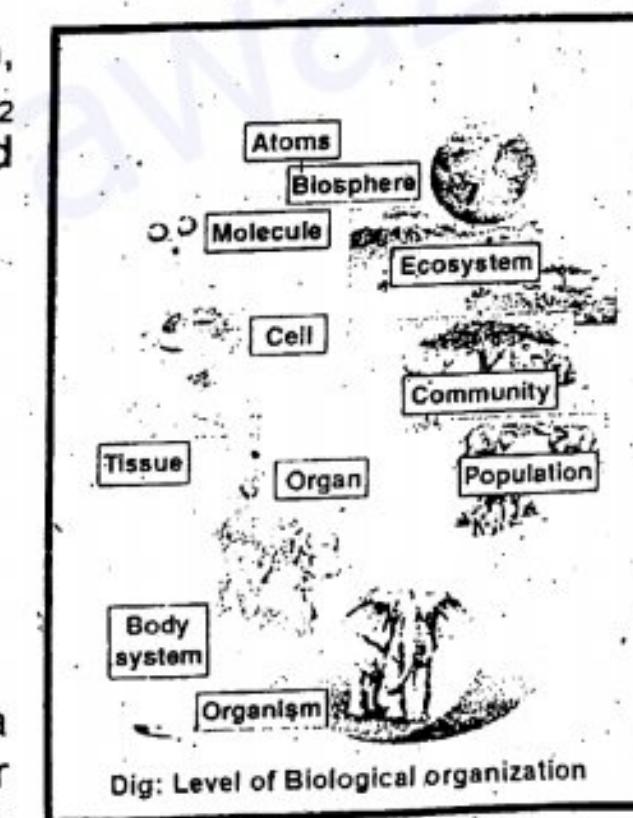
The compound except organic compounds are called inorganic compounds.

Example:

H_2O , CO_2 , etc.

III. Organelles level:

Different biomolecules combine in a particular way to form the sub cellular



structures 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 make the whole body like amoeba. While in multicellular organism whole organism consist of trillion of cells like human beings, plants etc.

V. Tissue:-

In multicellular organisms similar cells which perform similar function are organized into groups 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 combine 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 are 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 offspring is called Species.

Example:

Human, Brassica.

X. Population:-

A group of organisms of the same species living together in the same place in 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 the 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:-

Definition:-

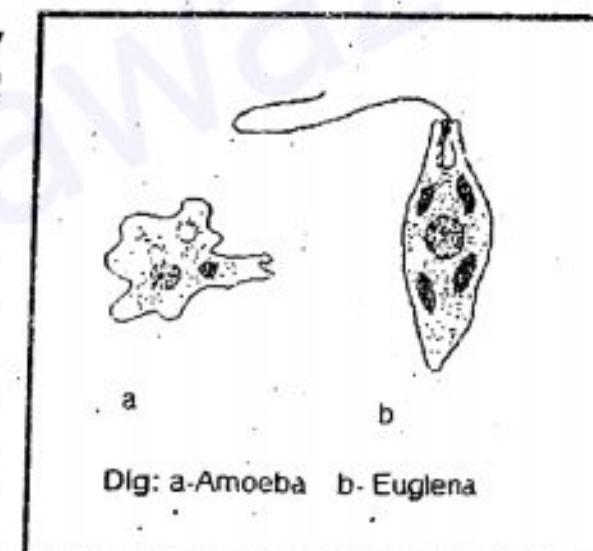
In living organism single cell or many Cells organize to form an organism called cellular organization.

Types 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 the life activities are carried out by the single cell. So there is division of labor among different organelles. Their single cells are capable of respiration, digestion, excretion, reproduction etc.



Dig: a-Amoeba b-Euglena

Example:-

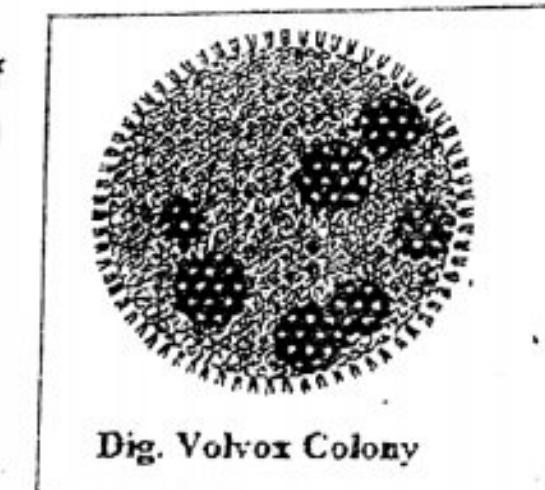
Euglena, Amoeba and Paramecium etc.

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 depend on other cells for its vital requirement.

Example: -

Volvox is a green alga found in water that shows colonial organization. Hundreds of Volvox cells make a small volvox colony



Dig: Mustard Plant

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 parts 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**MULTIPLE 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) paleontologist
2. How many people get lung cancer by smoking? This question can be answered through:
(a) Biometry (b) biophysics (c) Bio-economics (d) biogeography
3. Al-Qanun-fil-Tibb is the famous book of:
(a) Bu Ali Sina (b) Jabir Bin Hayyan
(b) Abdul Malik Asmi (d) 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 to:
(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) Fattyacid (d) Protein
8. "The number of plants in desert are scarce" this could be the statement of:
(a) Palaeontologist (b) social biologist
(c) Biogeographist (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?
(a) Unicellular (b) Multicellular
(c) Bicellular (d) Colonial

SHORT QUESTIONS**B. Write Short Answer of the following Questions.****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 understandings of physics for a biologist help 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.

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 honorable 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.

Q 3: Write the translation of any three verse of the Holy Quran related to the creation of mankind?**Ans:** See Q No.5**Q 4: Name few Muslim Scientists and their contributions in the field of biology and medicine?****Ans:** See Q No. 6

Q 5: 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:-

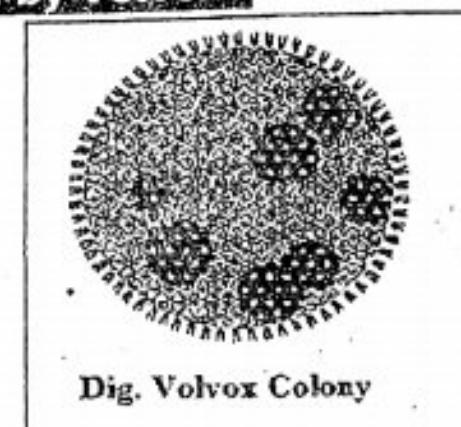
Volvox is a green algae found in fresh water.

Size:-

Each colony is the size of pin-head.

Number of cells:-

There are 500 to 60000 cells present 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 QUESTIONS**

C. 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.No.1

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

Ans; See Q No.07.

Q 4: Explain the role of Bioelements for living organisms?

Ans: Bio elements:-

Definition:-

The elements which make the body mass of a living organism are called bioelements.

Out of 92 natural occurring elements, 16 elements are called bioelements. In these 16 bioelements only six elements oxygen, carbon, Hydrogen, Nitrogen, calcium and Phosphorus make 99% of the total mass while other ten bio-elements potassium, sulphur, chlorine, sodium,

magnesium, iron, copper, manganese, zinc and iodine make 1% of the total mass.

- Oxygen = 65%
- Carbon = 18%
- Hydrogen = 10%
- Nitrogen = 03%
- Calcium = 02%
- Phosphorous=01%
- Other ten element = 01%

Importance of Bio elements:-**i. Hydrogen:**

Important element of water and organic compounds.

ii. Oxygen: -

Essential for Aerobic Respiration, Breathing, growth, element of water and organic compounds.

iii. Carbon:-

It is a key element of organic compound and Carbon dioxide. e.g. $C_6H_{12}O_6$, 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 play 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 component 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 play 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 enzymes in carbohydrate 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 play important role in the formation of Haemoglobin.

Haemoglobin: -Transport oxygen to all body cells.

xiii.Copper:-

It is essential for photosynthesis and respiration.

xiv.Zinc:-

In plants it is required for chlorophyll synthesis. While in animal it play 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.

Q 5: Who classified the living organisms into five kingdoms? Explain each kingdom with the living organisms included in it.

Ans: See Question 4

ADDITIONAL MULTIPLE CHOICE QUESTIONS

1. The word biology was first time used by
 a) Schawan b) Whitter c) Linnaeus d) Robert Hooke.
2. The word biology was first time used in
 a) 1733 b) 1734 c) 1735 d) 1736
3. The study of internal structure of organism.
 a) Morphology b) Anatomy c) histology d) physiology
4. The branch of biology in which we study the development of an organism from fertilized egg to new born baby.
 a) Embryology b) taxonomy c) cytology d) histology

5. The study of cell and their organelles.
 a) cell biology b) cytology c) histology d) Both A & B
6. The study of plants fossils is called
 a) Paleobotany b) Paleontology c) paleozoology d) Botany
7. The study of insect is called
 a) Physiology b) Entomology c) parasitology d) pharmacology
8. Use of organism for the benefit of humanity can be study in
 a) Biotechnology b) pharmacology
 c) entomology d) physiology
9. During absorption of light photosynthesis follows the laws of
 a) Physics b) chemistry c) biology d) astromology
10. Penicillin was discovered in
 a) 1927 b) 1928 c) 1929 d) 1930
11. The first discovered antibiotics is
 a) Aspirin b) Diclofenic c) Pencillin d) none of them
12. Who classified all organism into groups
 a) Robert Whittaker b) Robert Hooke
 c) Robert brown d) Robert Koch
13. Prokaryotes belong to kingdom
 a) Monera b) Fungi c) Protista d) Animalia
14. Plasmodium belong to kingdom
 a) Monera b) Fungi c) Protista d) animalia
15. "Al- Kheil" is about _____
 a) sheep b) Horse c) camels d) Human
16. Who is regarded as specialist of animals sciences
 a) AL- Farabi b) Bu Ali Sina
 c) Abdul Malik Asmai d) Ali Bin Isa
17. "Al- Qanun-fil -Tibb" is the famous book of
 a) Al-Farabi b) Bu Ali Sina
 c) Ali Bin Isa d) Ibn-ul- Nafees
18. Al- Qanun-fil-tibb is about
 a) Medicine b) Sheep's c) Camels d) horse
19. Who was famous for the removal of stone from urinary bladder?
 a) Al- Farabi b) Ibn-ul- Nafees
 c) Ali Bin Isa d) Abdul Qasim zahravi.
20. Which one of the following is considered as ophthalmologist.
 a) Ibn-ul- Nafees b) Al- Farabi
 c) Ali Bin Isa d) Ibn-ul- Haitham
21. Who described circulation of blood in human body.
 a) Al- Farabi b) Ali Bin Isa
 c) Ibn-ul- Nafees d) Ibn-ul- Haitham

22. Numbers of elements which form living bodies.
 a) 16 b) 17 c) 18 d) 19
23. The group of similar individual in an area is called
 a) species b) community c) Population d) ecosystem
24. All the ecosystem of the plant earth are collectively called
 a) Community b) Biosphere c) population d) ecosystem
25. Amoeba represents which level of organization.
 a) Unicellular b) colonial c) multicellular d) none of these
26. Volvox represent which level of organization
 a) Unicellular b) multicellular c) Colonial d) both A and B

THE TERMS TO KNOW

Agriculture	Entomology	Astronomy
Anatomy	Environment	Horticulture
Animal husbandry	glycogen	Epithelial tissue
neurosciences	Fisheries	Community
Bioelement	Forestry	Parasite
Biogeography	Fossil	Chitin
Biomathematics	Heterotrophic	Murein
Biosphere	Recreation	Immunology

Chapter No.2

Solving a Biological Problem

Q 1: 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 use 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 is conducted to check the reality of the observation.

Q 2: 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 Biotechnology 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 face 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 observations and also studies previous researches on the same problem.

Observations are made with five senses i.e., vision, hearing, smell, taste and touch. There are two types of observation,

S/No	Quantitative Observations	Qualitative Observation
1	It deals with 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.	Color, texture, smell, taste etc.
4	Examples: The freezing point of water is 0°C and the boiling point is 100°C . A liter of water weighs 1000 grams and a 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 untested statement before experiment. "So the temporary explanation of observation is called hypothesis". Biologist uses reasoning to formulate a hypothesis. Hypothesis consists of two types of 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 we 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 organisms 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 experiment.

Step (4): Deduction:-

In this step biologist draws deduction from hypothesis. For making deductions, the biologist takes hypothesis as true and draws out the expected results called deductions. 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 of biological method is experimentation. Biologist performs experiments on his hypothesis and checks the deductions. Through experiment they can find, that deduction of some hypothesis has come true while others have not. In

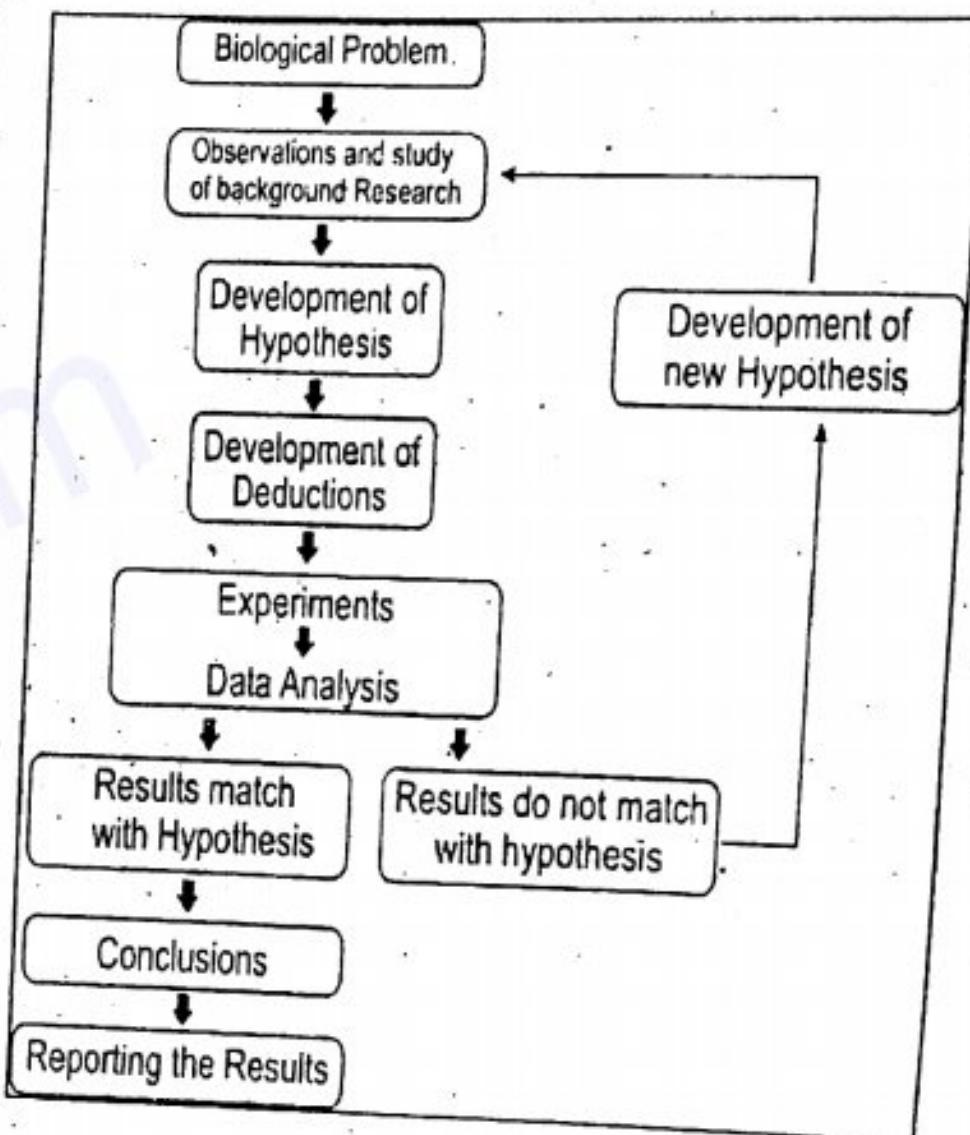
this way, the hypotheses are proved as true or false. The false hypotheses are rejected while the true ones are accepted.

In science when doing the experiment, it must be a controlled experiment. The scientist must contrast an experimental group (variable 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 analyzes 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.



Q 3: 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 "Bad"
- "Aria" mean "air"

Biological Problem 1: What is the cause of Malaria

Step 1: Observation:

- Malarial patient experienced repeating 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 malarial patient under microscope and found some microorganisms. Five years later, the same microorganisms were observed in the blood of malarial 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 accept 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 malarial patients 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 had Plasmodium in their blood; whereas the blood of healthy persons was free from Plasmodium.

Step 4: Conclusion:

The results were 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:

Biologists 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 observations. Some important observations of A.F.A King were:

- i. People who slept in open places suffered from malaria more than the people who slept indoors.
- ii. Individuals who slept near a smoky fire usually did not get malaria.
- iii. 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: Deduction:

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".

Step 4: Experiment:

Ronald Ross was a British army physician who worked in India in 1880's. He performed important experiment to test that mosquito are involve in transmission of plasmodium. He allowed a female Culex mosquito to bite sparrows suffering from malaria. Some of the mosquitoes 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. 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.

Result:

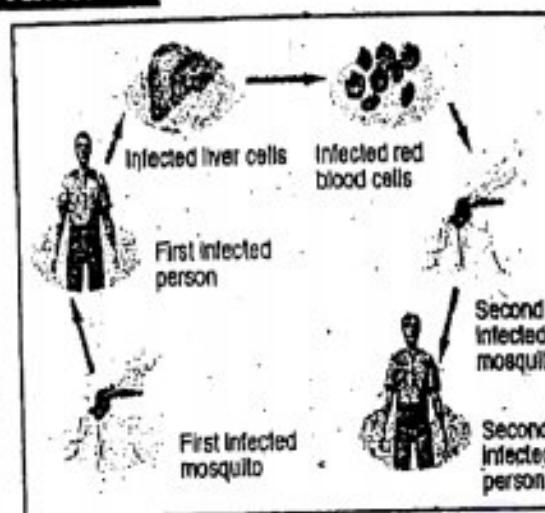
It was observed that the sparrows had Plasmodium in their blood.

Step 4: Conclusion:

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

Q 4: Explain the experiment of malaria on Human?**Ans: Experiment of Malaria on Human:**

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 later got malaria. In this way, it was confirmed that mosquitoes transmit plasmodium and spread malaria.

**Q 5: 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 favors it, then it becomes theory.(OR)

When hypothesis is proved to be correct by repeating experiments and never reject.

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 hypotheses from it and test them experimentally. If the new hypotheses are again proved, the original hypothesis becomes a theory.

Examples:-

- Cell theory
- Pressure flow theory

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:

Mendel's laws of inheritance.

Q 6 Discuss Data organization and Data Analysis?

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

Data organization:**Data:**

"Recorded observation and information is called data". OR
"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:

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

b.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 graphs, 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:

"It shows the relationship between two numbers".

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 $1:3$.

b. Proportion:

"Equality of two ratios". Proportion is denoted by 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 allow 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:**Sparrow:-**

$$a : b :: c : d$$



$$10x = 50 \times 6$$

$$10x = 300$$

Dividing both sides by 10.

$$\frac{10x}{10} = \frac{300}{10}$$

$$x = 30$$

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

Q 7: What is the relationship of biology with Mathematics?**Ans:-Mathematics as integral part of science:-**

Mathematics is used in biology in many fields.

Explanation:

Biological method also involves the use of mathematics to solve biological problems. Major biological problems in which knowledge of mathematics is used include gene finding, protein structure and the modeling of evolution.

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.

EXERCISE**MULTIPLE CHOICE QUESTIONS****A. Encircle the best suitable answers.**

1. Which one is the first step in biological method?
 (a) Hypothesis (b) experiment (c) Observations (d) Deduction
2. What is the correct experiment to know that plasmodium destroys red blood cells?
 (a) Examine the blood of a single healthy person
 (b) Examine the blood of a single infected person
 (c) Allow mosquito to bite a healthy person and examine his blood
 (d) Examine the blood of some healthy and also some infected person
3. What is the best way to analyze the data collected from experiments?
 (a) Reading the data and drawing conclusions
 (b) Discussion with scientists
 (c) Simple calculations on calculator
 (d) Application of statistical formulae
4. People who slept near smoky fire had less chance to suffer from malaria why?
 (a) Smoke kills plasmodium in their blood
 (b) Fire increases temperature and plasmodium are killed in air
 (c) Mosquitoes cannot tolerate smoke and are repelled
 (d) Smoke kills plasmodium present in mosquitoes
5. Which one of the following is NOT a characteristic of a hypothesis?
 (a) It must be consistent with all available data
 (b) It must be testable
 (c) It must be correct
 (d) Must make deductions
6. Deductions are made from:
 (a) Observations (b) Hypothesis (c) Experiment results
 (d) solution of biological problem
7. Which one of the following is true about the statement of hypothesis?
 (a) Logical (b) possible answer (c) Based upon observations
 (d) All of them

8. The actual answer to scientific problem is :
 (a) Observations (b) hypothesis (c) Data (d) Conclusion
9. Which mosquito can transmit plasmodium in human beings?
 (a) Anopheles (b) Culex (c) Aedes (d) All of these
10. For the first time, who found plasmodium in the blood of malarial patient?
 (a) Ronald Ross (b) Laveran (c) A.F.A. king (d) Mendel

SHORT QUESTIONS**B. Give short answers to the following questions****Q 1. What is science? How does science work?****Ans:- See Q No.1****Q 2. 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:

- i. To find more accurate and acceptable result of the experiment.
- ii. To compare the result with it.
- iii. To know the effect of treatment.

Example:

Blood of 100 healthy persons (control group) compared with 100 malarial patients.

Q 3: What deductions were developed during the study of malaria?

Ans: Biologist does not know whether his hypothesis is true or not, but he accept 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"

Q 4: 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 that mosquito are

- 3) Possible answer to a biological problem is called.
a) Deduction b) experiment c) Hypothesis d) observation
- 4) Which one of the following helps the biologist to do experiment?
a) Observation b) hypothesis c) Deduction d) both A and B
- 5) More than 2000 year ago which one disease is known as disease of chills and fevers?
a) AIDS b) typhoid c) Measles d) Malaria
- 6) In _____ century malaria was a major disease in Europe.
a) 14 b) 15 c) 16 d) 17
- 7) The word malaria is the combination of two _____ words.
a) Greek b) Roman c) Italian d) German
- 8) Who first noticed the microorganism in the blood of malarial patient?
a) Laveran b) Robert Brown c) Robert Hooke d) A-F-A King
- 9) The microorganism present in blood of malarial patient is called.
a) Plasmodium b) Virus c) Aedes d) Bacteria
- 10) Who was awarded noble prize for his work on the transmission of plasmodium.
a) A-F-A king b) Laveran c) Ronald Ross d) none of these
- 11) Name of the mosquito which transmits viruses of Dengue fever.
a) Culex b) Female Anopheles c) Aedes d) None of these
- 12) First step of scientific method is
a) Observation b) hypothesis c) deduction d) experiment
- 13) Recorded observation and information are called
a) Theory b) law c) hypothesis d) data
- 14) The actual answer to scientific problem is
a) Observation b) Conclusion c) data d) hypothesis
- 15) Which mosquito can transmit plasmodium in sparrow?
a) Anopheles b) Aedes c) Culex d) all of these

THE TERMS TO KNOW

Anopheles	Plasmodium	Biological method
Bioinformatics	Quinaquina	Deduction
Cinchonea	Theory	Observation
Control group	Variables	Hypothesis
Experimental group	Data	Stagnant water
Chill	Infected mosquito	

involve in transmission of plasmodium. He allowed a female Culex mosquito to bite sparrows suffering from malaria. Some of the mosquitoes 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. 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.

Q 5: 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 QUESTIONS

C. Give detailed answers to the following questions.

Q 1: Differentiate between inductive reasoning and deductive reasoning?

Ans: See Q No. 2

Q 2. Explain how biologists use scientific method to solve the mysteries of addressing the malarial problem?

Ans: See Q 3.

Q 3: Explain that how mathematics can be used to interpret the data obtained through experimentation.

Ans: See Q No.7 (See ratio, proportion and solved example)

ADDITIONAL MULTIPLE CHOICE QUESTIONS

- 1) There are _____ types of observation.
a) Two b) three c) four d) five
- 2) The two type of observation are qualitative and _____.
a) Quantitative b) hypothesis c) deduction d) none of these

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.

- Bios mean life.
- Diversity means 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 millions organisms which have been identified. Out of these two millions 1.5 million are animals and 0.5 million are plants. In Pakistan, there are about 6000 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, fibers, dyes, resins, gums, rubber and oil are some of the industrial materials derived from the plants.

iv. Relation with ecosystem;

Biodiversity play 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 some point in their evolutionary histories.

iii. Later biologists began 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 differences 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. Morphology of organism:

Organisms are classified on the basis of their apparent similarities such as color, height, weight etc.

ii. Anatomy:

On the basis of internal structure and stages of development.

iii. Evolution:

Evolutionary history is also considered during classification.

iv. Genetics and Biochemistry:

Genetics and Biochemistry of different organisms 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:-

Species consists of similar interbreeding organisms.

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

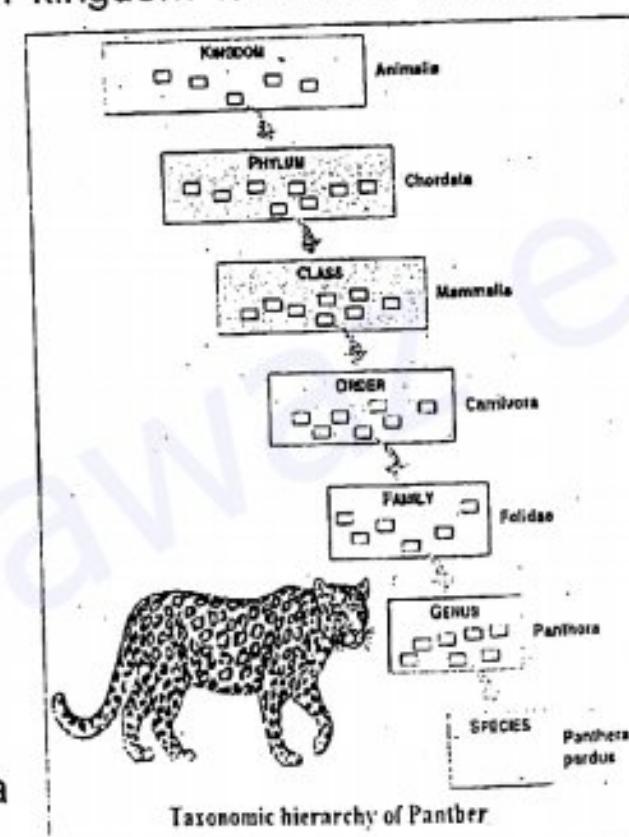
IV) Order:-

An order is a group of related families.

Example: Carnivores

V) Class:-

A group of similar orders 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	Ameoba	mustard	Mushroom	Man	Panther
Kingdom	Protista	Plantae	Fungi	Animalia	Animalia
Phylum	Protozoa	Tracheophyta	Mycota	Chordate	Chordate
Class	Sarcodina	Angiospermae	Basidiomycota	Mammalian	Mammalian
Order	Ameobidales	Brassicales	Agaricales	Primates	Carnivora
Family	Ameobidae	Brassicaceae	Agaricaceae	Hominidae	Felidae
Genus	Amoeba	Brassica	Agaricus	Homo	Panther
Species	Amoeba proteus	Brassica campestris	Agaricus campestris	Homo sapiens	Panthera pardus

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) Contribution of Abu Usman Umer Al-Jahiz:

Date of Birth: He was born in Basra in 776 – 869 A.D.

Contribution: He described the life system of ants and his own observations 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 (heterotrophs) from plants (autotrophs). 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 are also known as prokaryotes.
- ii. They contain prokaryotic organisms.
- iii. All these organisms are unicellular and microscopic
- iv. Nuclear membrane and membrane bounded organelles are also absent.
- v. Their cell wall is made up of murine (sugar + amino acid also called Peptidoglycan)
- vi. They are simplest of all living organisms.

Examples:-

Bacteria, blue green Algae (cyanobacteria).

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

- i. These organisms have dual nature.
- ii. It includes eukaryotic unicellular and simple multicellular organisms.
- iii. Usually live in aquatic habitat.
- iv. Some contain chlorophyll and prepare their own food while some lack chlorophyll and cannot prepare their own food.
- v. 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).
- vi. They remain stationary.

Example:-

Bread mold, mushroom, puffballs and yeast etc.

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- v. They take their food by absorption (saprophyte).
- vi. They remain stationary.

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.
- vi. They also remain stationary.

Examples:-

Wheat, Pines, Mango, Mulberry, ferns etc.

V) Kingdom Animalia:-**Characteristics:-**

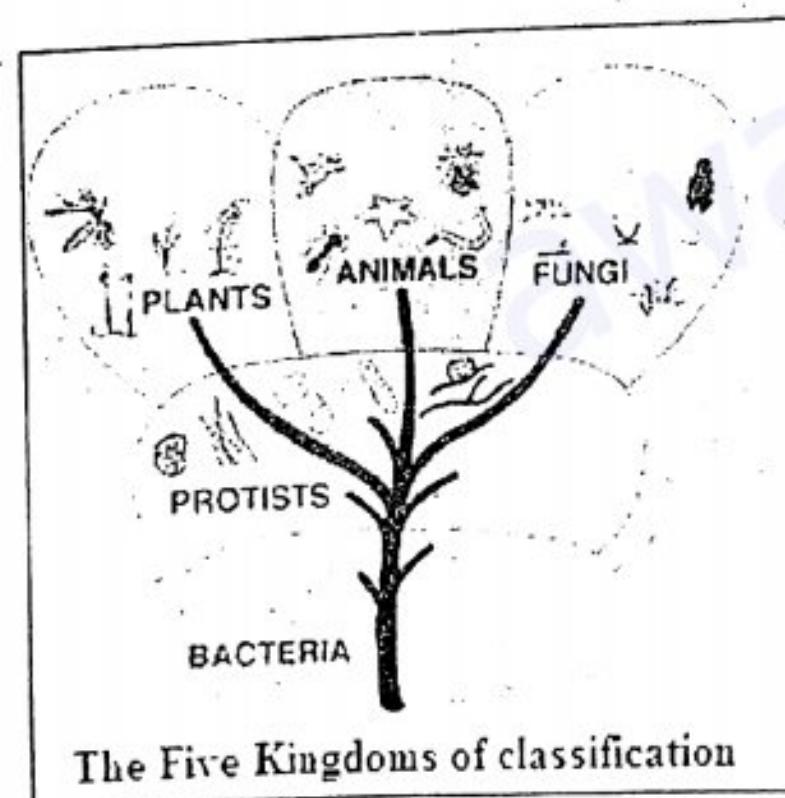
- i. They include eukaryotic multicellular animals.
- ii. Centrioles are present in the cells.
- iii. They have no chlorophyll and cannot prepare their own food.
- iv. This kingdom contains both vertebrate and invertebrate animals.
- v. They are motile.

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 1753.	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 the distinguishing characteristics 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 Iwanowaskyin 1892.

Meaning :-

The word virus is derived from Latin word "venom" which means poisonous fluid.

Virology:

Study of virus is called virology.

Definition:-

Viruses are non-cellular unique particles at the borderline of living and non-living organism.

Structure of Virus:-

The virus consists of two main parts.

i) Outer protein coat called capsid.

ii) The inner nucleic acid core contain DNA Or RNA.

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:

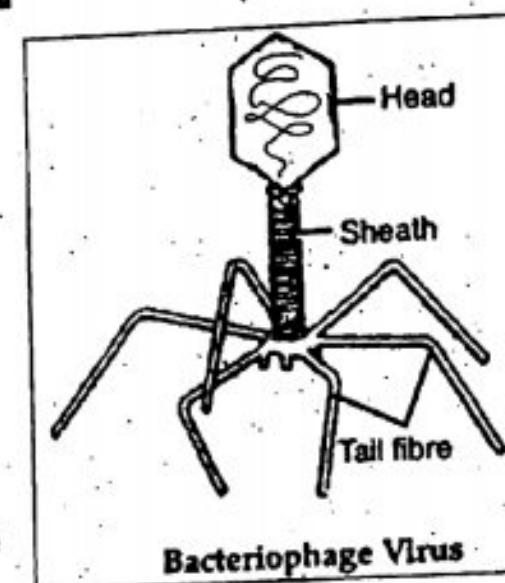
- i. Viruses cannot live without a host cell and can be crystallized.
- ii. They can be crystallized outside the host cell.
- iii. They cannot respire.
- iv. They cannot excrete.

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

Ans:- Binomial nomenclature:

Meaning:-

- Bi means two,
- Nominal means names,



Definition:

Two words naming system is called Binomial nomenclature. It is the method of giving scientific names to living organisms.

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 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:-

Homo sapien is the zoological name of man. In this name homo is the genus and Sapien is the specie.

Importance of binomial nomenclature:-

i. Specific:

These names are more definite and precise than common names. Common names have no scientific basis.

ii. Universal acceptance:

Being generally in Latin, they have a universal acceptance by people of all languages.

iii. Descriptive:

They are usually descriptive and easier to study.

iv. Evolutionary relationship:

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 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	<i>Nymphaea lotus</i>
Tambaku	Tobacco	<i>Nicotiana tabacum</i>
Dharek	Neem	<i>Melia azedarach</i>
Surajmukhi	Sun flower	<i>Helianthus annus</i>
Lehsan	Garlic	<i>Allium sativum</i>
PhoolMatar	Sweet pea	<i>Lathyrus odoratus</i>
Sharsham	Mustard	<i>Brassica campestris</i>
Rubber	Rubber	<i>Ficus elastic</i>
Pepal	Sacred fig	<i>Ficus religiosa</i>
Banyan	Banyan	<i>Ficus bengalensis</i>

Zoological names:

Local name	English name	Zoological name
Makhi	House fly	<i>Musca domestica</i>
Zarapha	Giraffe	<i>Giraffa camelopardalis</i>
Kharpusht	Porcupine	<i>Hystrix lecura</i>
Bille	Cat	<i>Felis domesticus</i>
Titlee	Butterfly	<i>Pieris rapae</i>
Kechwa	Earth worm	<i>Pheretima posthuma</i>
Kutta	Dogs	<i>Canis familiaris</i>
Markhor	Markhor	<i>Capra falconeri</i>
Talor	Talor	<i>Houbara bustard</i>
Lomri	Wolf	<i>Canis lupus</i>
Babar sher	Lion	<i>Felis leo</i>
Bengal sher	Tiger	<i>Felis tigris</i>

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 fulfill 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 examples with references to Pakistan.

Ans: Extinct species:

Species 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 species 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 fulfill the demands of food, people are clearing forests and developing agricultural lands and residential colonies. Deforestation mean cutting down of trees without proper planning is called deforestation.

In Pakistan, forests cover only 2.5 % 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 new species is introduced in an ecosystem. It may prove harmful for the existence of other 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 wild life.

Ans:- Wild life:-

Definition:-

The wild animals and plants in their natural habitat 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:

<i>Taxus baccata</i>	(yew)
<i>Pinus geradiana</i>	(chilgoza)
<i>Juniperus macropoda</i>	(sanobar)



The above plants species have become endangered in Pakistan

Some endangered animal species in Pakistan:

<i>Capra falconeri</i>	(markhor)
<i>Houbara bustard</i>	(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.**Ans:- Deforestation:-****Definition:-**

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

Causes of deforestation:-**i.Extension of cities:**

Extension of cities requires more land, thus forests are cut to build roads and houses etc.

ii.Over population:

Over population need more land for agricultural activities thus forest are cut down.

iii.Creating pastures:

Trees are also removed to develop pastures for grazing.

iv.Wood

Wood is used both as timber and as fuel wood.

v.Easy cash:

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 has 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 dolphins.

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

II. Northern areas conservation project:

The northern area of Pakistan serves as a habitat for a number of wildlife species. The survival of these species is 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 Chiltan Markhor:
Hazarganj national park is located close to Quatta and is the only remaining habitat of chiltan Markhor 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 an end to this cruel sport.

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

VII. Indus Dolphin Project to save Indus Dolphin

VIII. Marine Turtle conservation Project.

EXERCISE

MULTIPLE CHOICE QUESTIONS

A. Encircle the best suitable answers.

1. Which character of viruses makes their resemblance with living organisms?
 - (a) They can be crystallized
 - (b) they cannot live outside host body
 - (c) They contain DNA or RNA
 - (d) All of the above
2. Euglena belongs to the kingdom Protista because:
 - (a) It is unicellular
 - (b) it is Eukaryotic
 - (c) having both plant and animal like characters
 - (d) it lives in water
3. The correct sequence of hierarchy from small to large units is :
 - (a) Genus → family → order → class
 - (b) Family → order → class → genus
 - (c) Genus → family → class → order
 - (d) Species → family → genus → class
4. The kingdom which contains eukaryotic, autotrophic organisms is :
 - (a) Protista
 - (b) Monera
 - (c) Fungi
 - (d) None of them
5. The five kingdom system of classification was modified by :
 - (a) Robert Whittaker
 - (b) Margulis and Schwartz
 - (c) Carlos Linnaeus
 - (d) Aristotle
6. Aristotle classified organisms on the basis of :
 - (a) Habitat
 - (b) cell structure
 - (c) morphology
 - (d) anatomy
7. Which of the following kingdoms possesses the simplest organism?
 - (a) Fungi
 - (b) Monera
 - (c) protista
 - (d) plantae
8. What is binomial nomenclature?
 - (a) Classifying organisms on seven levels
 - (b) Naming system developed by Aristotle
 - (c) Grouping animals based on their habitat
 - (d) Naming system in which each organism is given two- part name

9. Which one may by the correct way of writing scientific name of an organism?
 (a) *Canis lupus* (b) *saccharum*
 (c) giant's gazelle (d) *Escherichia coli*
10. Which kingdom includes organism with cell wall but without chlorophyll?
 (a) Protista (b) Fungi (c) plantae (d) Animalia
11. Which one is the basic unit of classification?
 (a) Genus (b) Species (c) family (d) order
12. Maximum biodiversity is found in :
 (a) Forests (b) grasslands (c) Deserts (d) mountains.

SHORT QUESTIONS

B. Write short answer of the following Questions?

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. Climatic changes occurs which result in formation of desert.

Q 2. 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 between living organisms.
- iv. It also helps biologist to give an idea about the sequence of evolution among organism.

Q 3: What is the status of viruses in classification?

Ans: Status of virus in classification:

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:

- v. They can reproduce inside the host cell(obligate parasite)
- vi. They contain nucleic acid either DNA or RNA as hereditary materials.
- vii. They can grow inside the host cell.
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Non-Living characteristics:

- v. Viruses cannot live without a host cell and can be crystallized.
- vi. They can be crystallized outside the host cell.
- vii. They cannot respire.
- viii. They cannot excrete.

Q 4: 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 murine	various type
Membrane bounded organelle	Absent	Present

Q 5. List down the endangered species of Pakistan? And what are the reasons behind their population decrease?

Ans: See Q No.17.

LONG QUESTIONS

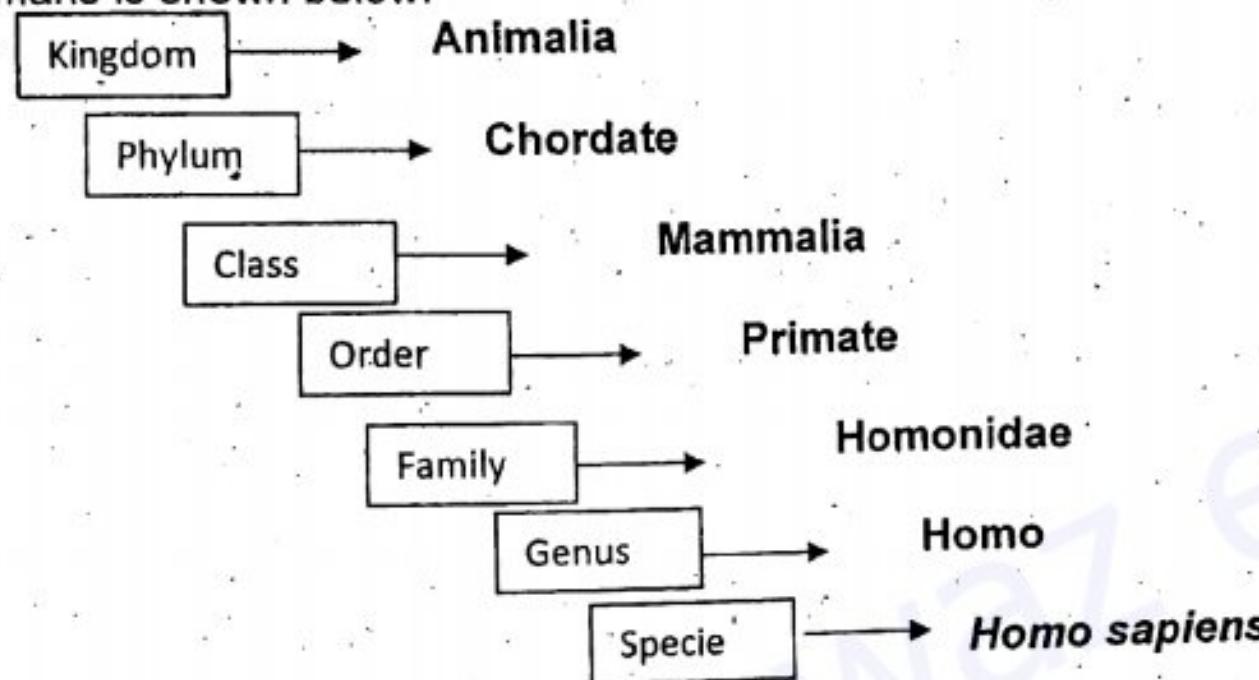
C: Give detailed answers of the following Questions.

Q i: Differentiate between two kingdom system and five kingdom system along their advantages and disadvantages:

Ans: Q.No. 8

Q ii: Take on organisms and assign it to different ranks according to hierarchy of taxonomy?

Ans; The groups into which organism are classified are known as taxonomic categories or taxa (singular "taxon") and these taxa form a ladder, called taxonomic hierarchy. For example the taxonomic hierarchy of humans is shown below.



Q iii: How human activities affect 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 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 or binomial nomenclature.

Examples:-

Homo Sapien is the zoological name of man. In this name homo is the genus and Sapien 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 indicate 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.

Q 5. 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 the 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:

Climatic 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 to conserve biodiversity:

- 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 by preventing deforestation.
- Wild life parks, game sanctuaries and zoo should establish.
- Aforestation and re-forestation are required.
-

ADDITIONAL MULTIPLE CHOICE QUESTIONS

- 1) There are about _____ millions different types of living organism in the world.
a) two million b) three million c) six millions d) ten million
- 2) In Pakistan there are about _____ kinds of plants.
a) 4000 b) 5000 c) 6000 d) 8000
- 3) In Pakistan there are _____ types of animals.
a) 20,000 b) 23,000 c) 25,000 d) 27,000
- 4) The term "biodiversity" is derived from
a) Italian word b) Roman word c) English d) Greek
- 5) The variety of organisms present on earth is called _____
a) Biodiversity b) Biophysics c) Bioenergetics d) Bioeconomics
- 6) Drugs such as streptomycin, neomycin and erythromycin are derived from
a) bacteria b) plants c) Fungi d) Algae
- 7) There are _____ plants which depend on bees for pollination.
a) 110,000 b) 115,000 c) 120,000 d) 130,000
- 8) Who classified organism on the basis of their habitat.
a) Linnaeus b) Whittaker c) Aristotle d) Both of them
- 9) A group of similar organism which can freely interbreed and produce fertile offspring is
a) Genus b) family c) Order d) Species

- 10) Member of the same species have the same number of
a) Cells b) chromosomes c) tissues d) none of these
- 11) The smallest unit of classification is
a) Specie b) kingdom c) phylum d) order
- 12) The largest unit of classification is called
a) Species b) kingdom c) phylum d) Order
- 13) Panther belong to phylum
a) Tracheophyta b) mycota c) protozoa d) chordate
- 14) Mushroom belong to phylum
a) Protozoa b) Traheophyta c) mycota d) chordate
- 15) *Agaricus campestris* is the scientific name of
a) Mushroom b) mustard c) Neem d) none of these
- 16) *Homo sapiens* is the zoological name of
a) frog b) cat c) man d) Amoeba
- 17) The first systematic classification was proposed by
a) Al- Jahiz b) Whittaker c) Aristotle d) Linnaeus
- 18) Name the organisms which get their food by absorption
a) Plants b) Animals c) Fungi d) Algae
- 19) Cells wall made of chitin in
a) Plants b) animals c) Fungi d) Protista
- 20) Cell wall made of murine in
a) Plants b) bacteria c) Euglena d) Fungi
- 21) Yeast belongs to kingdom.
a) Monera b) Protista c) Fungi d) Fungi
- 22) Two kingdom system was proposed by Carolus Linnaeus in
a) 1750 b) 1751 c) 1752 d) 1753
- 23) Cell wall are absent in
a) animals b) plants c) bacteria d) 1753
- 24) Viruses belong to kingdom.
a) Monera b) Protista c) Fungi d) Fungi
- 25) The scientific name of papal is
a) *Ficus elastica* b) *Ficus bengalensis*
c) *Ficus religiosa* d) *Helanthus annus* d) None of these
- 26) The scientific name of Rubber.
a) *Ficus elastica* b) *Ficus bengalensis* c) *Ficus religiosa* d) *none*
- 27) The species which no longer lives anywhere on the earth is called
a) Endangered species b) extinct species
c) threatened species d) dominant species

- 28) The species which are in the danger of extinction are called
 a) Endangered species b) extinct species
 c) Threatened species d) both A and B.
- 29) Biological name of talor is
 a) *Capra falconeri* b) *Rana Tigrina*
 c) *Houbara bustard* d) cranes
- 30) Which one is the national animal of Pakistan
 a) Kangroo b) talor c) Markhor d) tiger
- 31) In Pakistan forest cover _____ of the land.
 a) 2.1 % b) 2.2 % c) 2.4 % d) 2.5 %
- 32) Star fish eats
 a) mussels b) Plankton c) fishes d) amphibians.
- 33) The glands of which animal is used for making perfume.
 a) Markhor b) Musk deer c) Marcopolo sheep d) both A and C
- 34) Pakistan has _____ national Parks.
 a) 26 b) 27 c) 29 d) 30
- 35) Which one is the largest flower?
 a) Rose b) pensy c) Jasmine d) Rafflesia

THE TERMS TO KNOW

Ecosystem	Timber mafia	Conservation
Tropical region	migration	Deforestation
Polar region	IUCN	Reforestation
Morphine	Viroid	Biodiversity
Homologous structure	WWF	Flora
migration	Prion	Fauna

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 cells 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 plants but absent in animals.

Q 3: Define microscopy? Explain Microscope and their types?

Ans: Microscopy:

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

Microscope:-

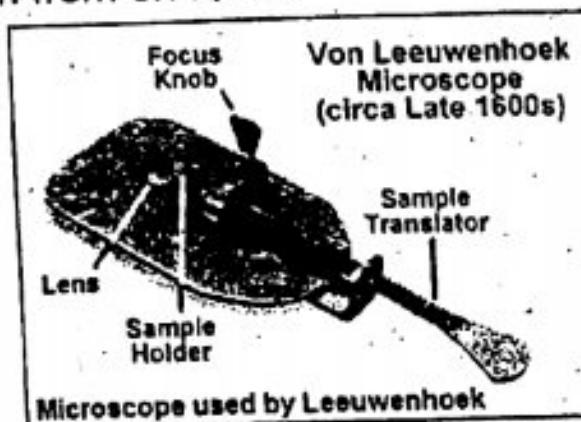
It is an instrument which is used for the observation of those things which cannot be seen with naked eyes.

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 a 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.

**Q 4: 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 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 0.1 mm apart. This is known as resolution of human eye. The resolution power of light microscope is 0.2 μm .

Q 5: Write the characteristic features of light and electron microscope?**Ans: light microscope:****Definition:**

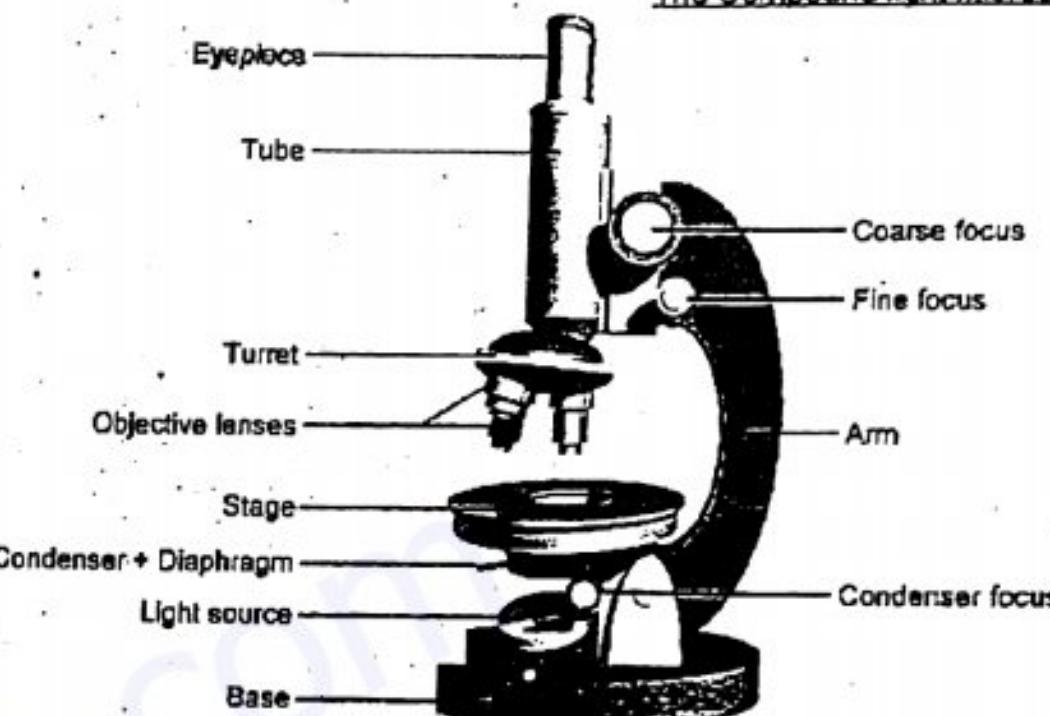
Those microscope which uses light to make the image of an object is called light microscope.

Light pathway:

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

Image formation:

One 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 where an enlarge and clear image is formed.

The Compound light Microscope**Magnification:**

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

Resolution:

The resolution of light microscope is 0.2 μm .

Electron microscope:**Definition:**

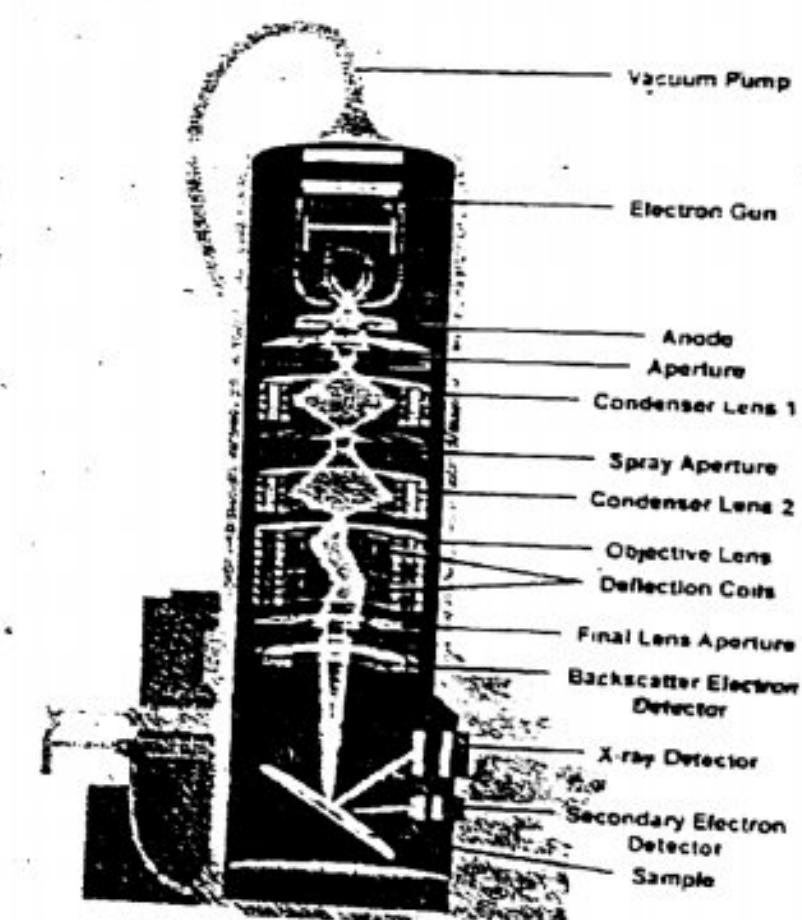
It is the most advance form of microscope which use beam of electron to make the image of an object.

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 object 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 0.2 nm.

Types of Electron Microscope:-

There are two types of electron microscope:

Scanning electron microscope (SEM):-

- It is used to study the detail of surface of cells and other objects.
- The surface of object is coated with metal.
- It shows 3D images.

Transmission electron microscope (TEM):-

- It is used for the study of internal structure of cell or any other object.
- It produce 2D images.
- It can magnify objects about 250,000 times.

Q 6: 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 nm	0.005 nm

Q 7: 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 Leeuwenhoek:-

Leeuwenhoek was a Dutch scientist. He studied a drop of 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. Leeuwenhoek 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 scientists were interested in microscopy.

Robert Brown:-

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

Mathias Schleiden:-

In 1838, 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 form i.e., "all living things are composed of living cells".

Evengesta Purkyne:-

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 Virchow:-

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.

Q 8: 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 Schwann.

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.

Q 9 : What do you meant by acellular or sub-cellular particles?**Ans: Acellular and Sub-cellular particles:**

According to the 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 organism's i.e, they can increase in number and can transmit their characteristics to the next generation.

Viroid:

Viroid are plants pathogen composed of RNA (single strand circular RNA).

Prion:

Prions are composed of protein molecule only.

Virus:

Virus is composed of protein, DNA or RNA.

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 murine respectively.

Structural of Cell Wall:-

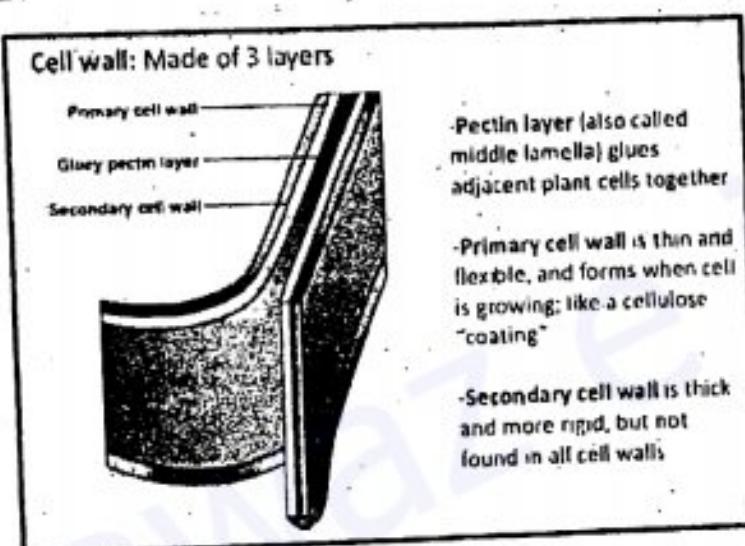
Cell wall is mainly composed of three main layers.

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 substance 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?**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 wall is 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 some protein are floating over it while some stay embedded in the bilayer. Carbohydrate molecules are joined with proteins (Glycoprotein) or with lipid (Glycolipid).

Cell membrane as semi permeable membrane:-

Cell membrane is a semi permeable membrane because it controls the inflow and outflow of materials of cell. It is thin, delicate and elastic. It controls the movement of the molecules passing through it. It allows only the passage of water and other small molecules such as gases freely 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.

Q 13: Describe the structure and function of Endoplasmic Reticulum?

Ans: Endoplasmic Reticulum:-

Terminology:-

- Endo means internal
- Plasmic 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:-

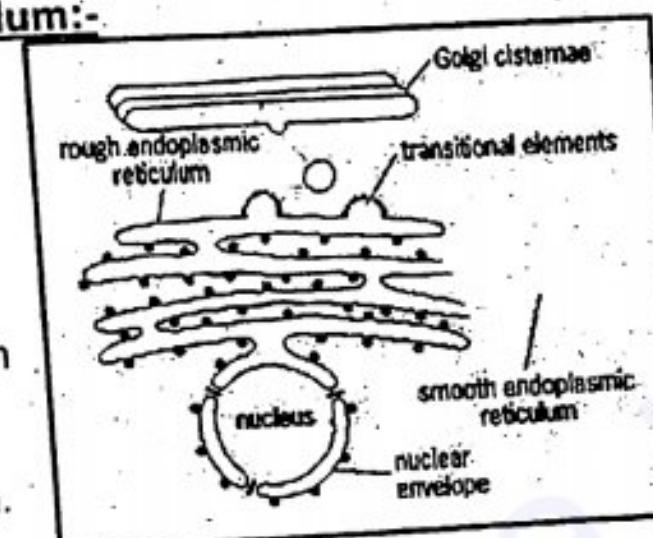
There are two type of endoplasmic reticulum.

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 ribosomes 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.

Q 14: Describe the structure and function of mitochondria?

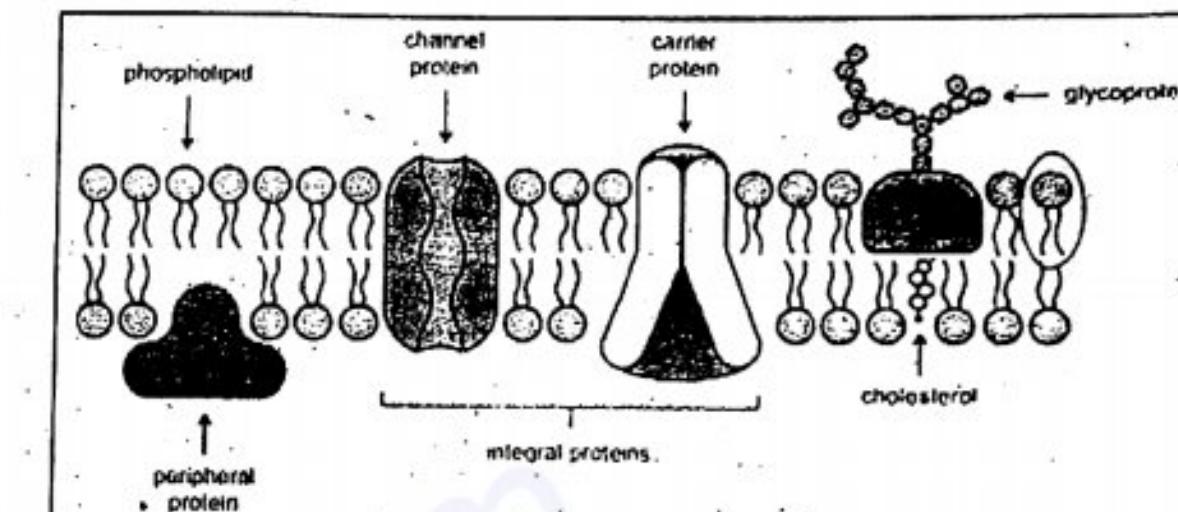
Mitochondria:-

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

Shape:-

Mitochondria are oval, rod shaped or filamentous shape bodies.

- **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.

Characteristic:

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:

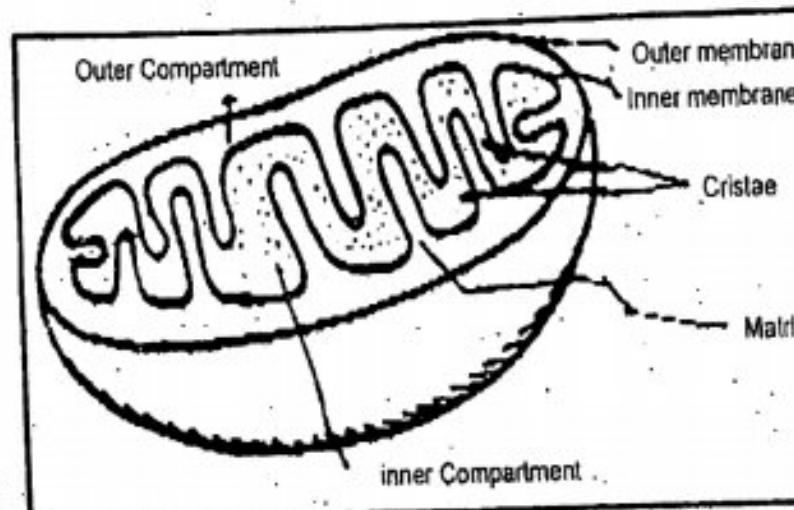
- The cytoplasm of the cell provides space for the proper functioning of the organelles
- It also act as the site for various metabolic reactions, for example Glycolysis (breakdown of glucose during cellular respiration)
- Cytoplasm store useful substance like protein, lipid, vitamin, carbohydrates.

Discovery:-

They were discovered by Richard Altmann in 1890 in muscle cell.

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 because it has own DNA and Ribosomes

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 in mitochondria.

Q 15: Explain the structure and function of Golgi Bodies?**Golgi Bodies:-**

Golgi bodies were first discovered by an Italian scientist Camillo Golgi in 1898.

Shape:-

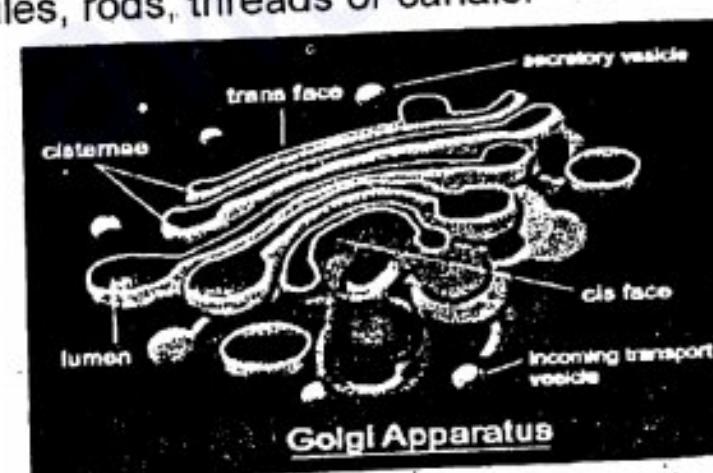
Golgi bodies are in the form of granules, rods, threads or canals.

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 dictyosome.

**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.

Q 16: Describe the structure and function of Ribosome and Plastid?**Ans: i). Ribosomes:-**

Ribosomes are the only organelles found in all prokaryotic and eukaryotic cells. It is non-membrane bounded structure.

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 combine to form ribosome.

Formation:-

They are produced in nucleolus.

Composition:

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

Size:-**Eukaryotic Ribosome:**

- Ribosome present in eukaryotes is of 80S.

Prokaryotic Ribosome:

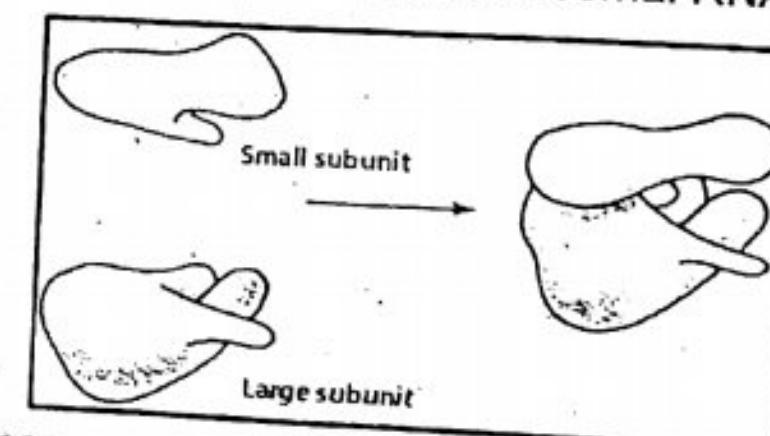
- Ribosome of prokaryotic cell is of 70S.

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 protist (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 stack of coins is called granum. All the granum collectively called grana.

Thylakoid:-

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

Intergrana:-

Grana is attached with each other by intergrana.

Stroma:-

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

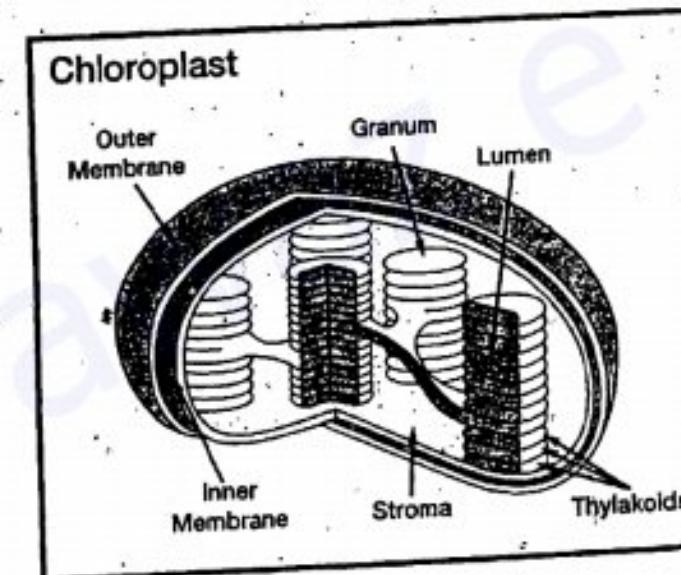
Function:-

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:-

Position:-

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:

Leucoplasts are 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.

Q 17: 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:

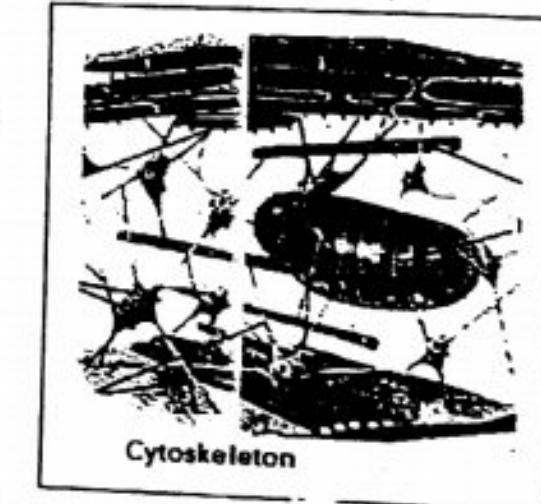
Microtubules are made up of a protein called tubulin.

ii. Microfilaments:

Microfilaments are made up of a protein called actin. These microfilaments are approximately one-third 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, hold organelles in place and moves parts of the cell in processes of growth and motility.

Q 18: Write short note on centriols 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. They are absent in higher plants.

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 micrometer in diameter.

Triplet:-

A group of three microtubule 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:-

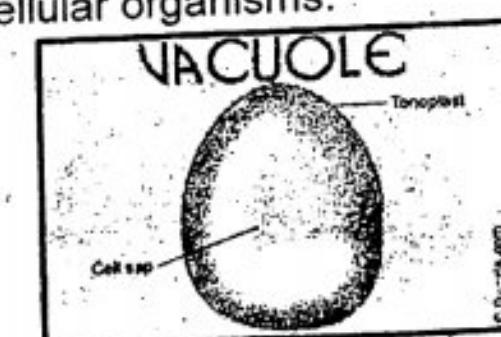
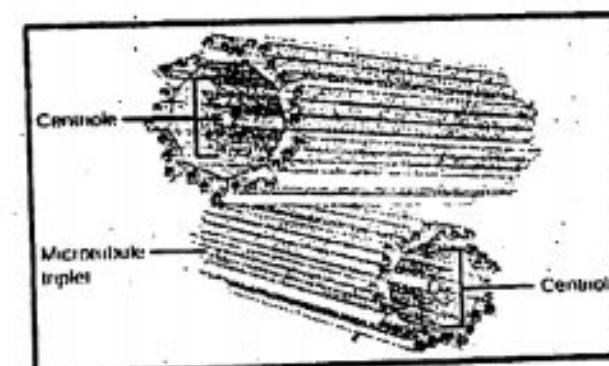
In animal cell, they help in the formation of spindle fibers which help in the separation and movement of chromosomes during cell division.

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 are 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 materials 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.

Q 19: 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 lysosome fuse 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).

Q 20: 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:-

Nucleus was discovered by Robert Brown in 1833.

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 nucleoli. (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 of protein synthesis.

iv.Chromosomes:-

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

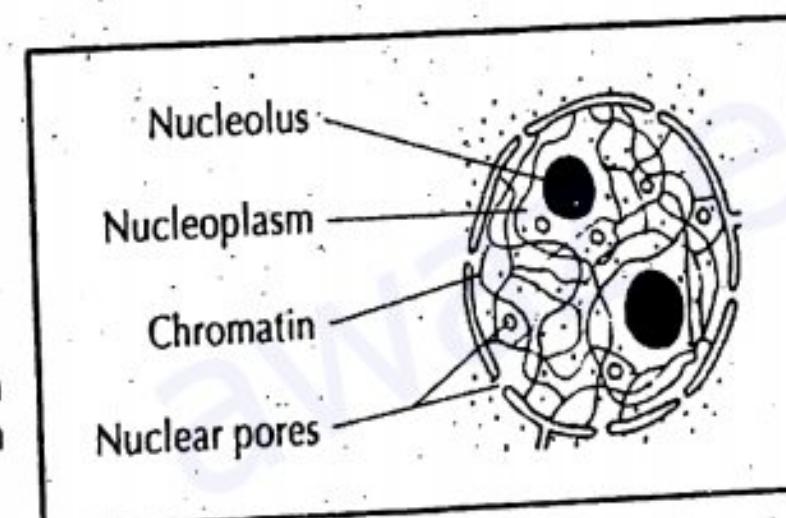
Terminology:-

The word chromosomes have derived from two words.

- **Chroma** mean colour..
- **Soma** mean bodies.

Chemical Composition:-

Chromosomes are made of DNA and proteins.

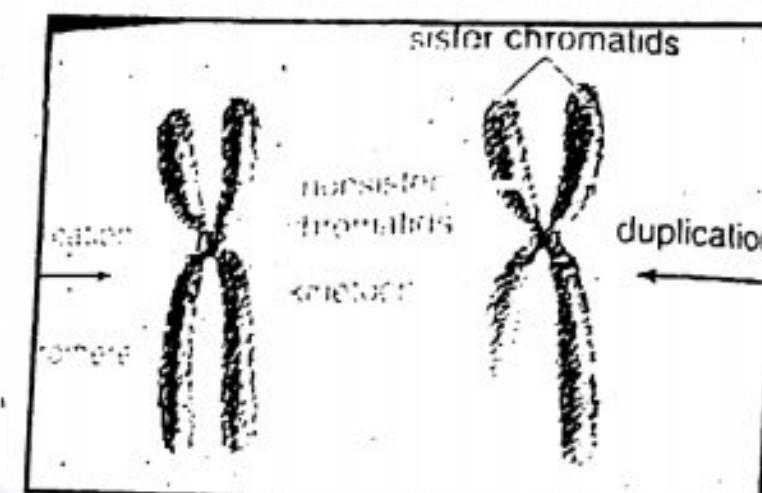
**Structure:-**

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 number of chromosomes. Chromosomes in different species are given below.

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

Q 21: Difference between prokaryotic and eukaryotic cell?

	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 murine.	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 involved in photosynthesis have chloroplast.

Animals:-

- In animals, nerve cells are responsible for the transmission of impulses.
- Muscular cells are responsible for movement.
- Red blood cells carry oxygen and white blood cells kill foreign agents germs.

Relation between cell function and cell structure:

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

Size and shape	<ul style="list-style-type: none"> • 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 hemoglobin
Surface area to volume ratio	<ul style="list-style-type: none"> • Root hair cells have large surface area for the maximum absorption of water and salts.
Presence or absence of organelles	<ul style="list-style-type: none"> • Cells involved in making secretions 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.

Q 24: Explain how surface area to volume ratio limits cell size.**Ans: Cell size and surface area to volume ratio:**

Cells are very greatly in size. The smallest cells are bacteria, with diameter between $0.1 \mu\text{m}$ to $1.0 \mu\text{m}$. 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.

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

$$\text{Volume} = 30 \mu\text{m} \times 30 \mu\text{m} \times 30 \mu\text{m} = 27,000 \mu\text{m}^3$$

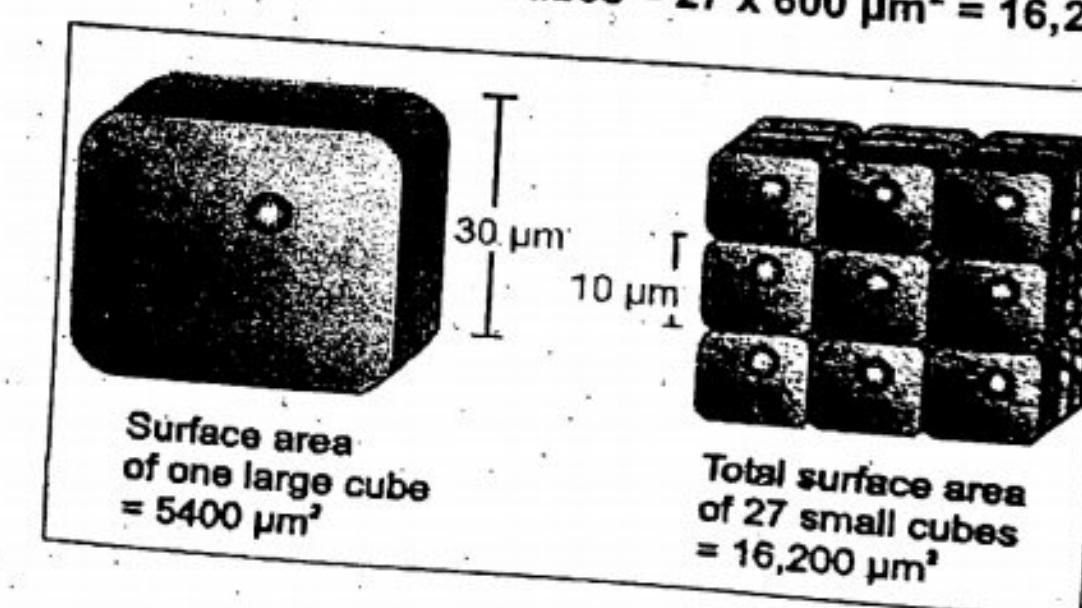
- In contrast to total volume, the total surface areas are very different. Because the cubical shape has 6 sides, its surface area is 6 times the area of 1 side.

The total surface area of the cubes are as follows:-

$$\text{Surface area of 1 large cube} = 6 \times (30 \mu\text{m} \times 30 \mu\text{m}) = 5400 \mu\text{m}^2$$

$$\text{Surface area of 1 small cube} = 6 \times (10 \mu\text{m} \times 10 \mu\text{m}) = 600 \mu\text{m}^2$$

$$\text{Surface area of 27 small cubes} = 27 \times 600 \mu\text{m}^2 = 16,200 \mu\text{m}^2$$



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.

Q 25: 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:-

- Diffusion
- Facilitate diffusion
- 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 fulfill the requirement of the cells.

Importance:

- 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 facilitate 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 the help of facilitate proteins present in cell membranes. The rate of 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.

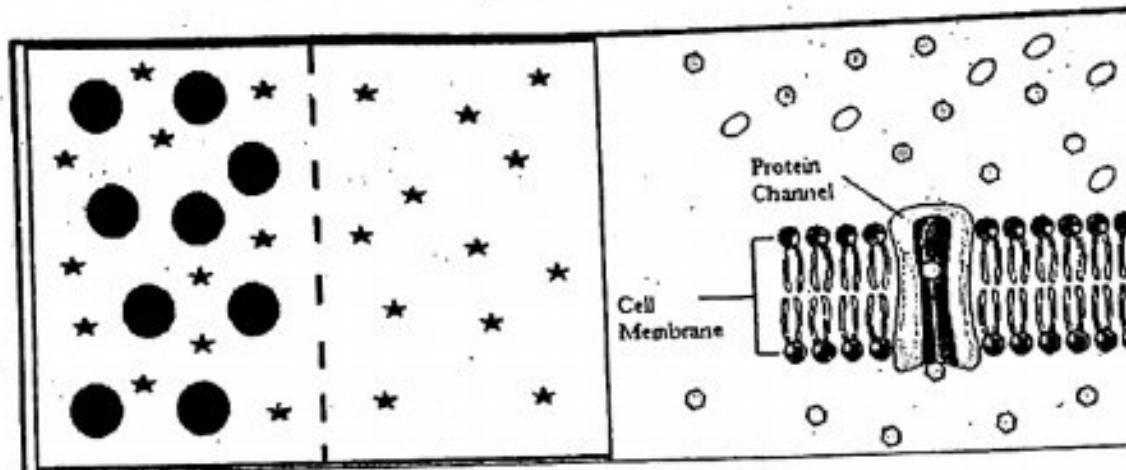
3. Osmosis:-

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.



Q 26: 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 cell 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:-

- It keeps the herbaceous plants erect.
- It helps in opening and closing of stomata.
- Some flower open during day time and close at night time, this is due to change in turgor.
- It gives proper shape to the cell.
- 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 plasmolysed 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

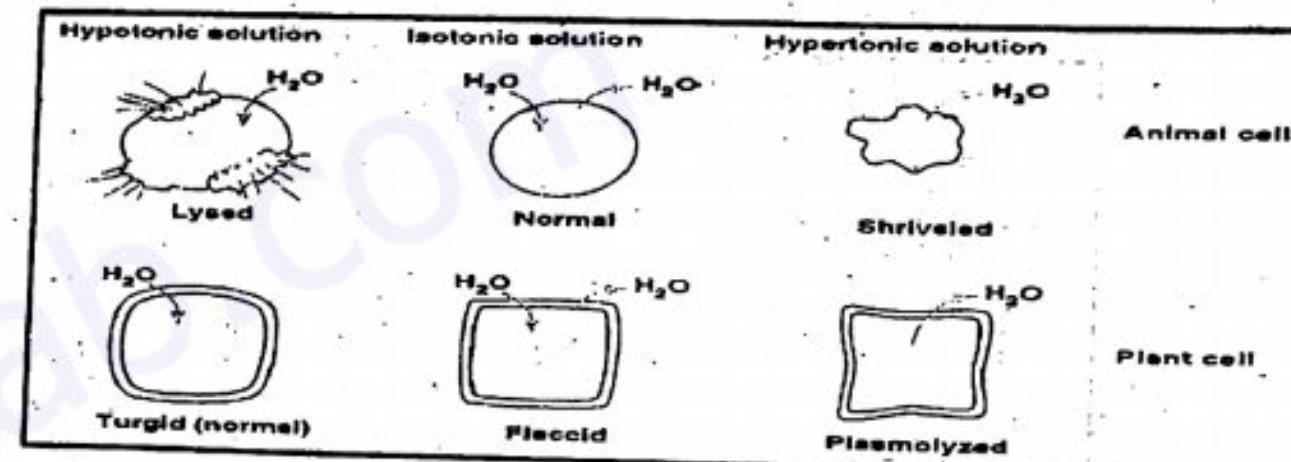
become shrinking. This phenomenon is called plasmolysis and the cell is also called plasmolysed cell.

Deplasmolysis:

The condition in which plasmolysed regain its shape due to absorption of water.

Mechanism:

When a plasmolysed cell is placed in hypotonic solution the cell absorb water and restore its turgidity. This process is called plasmolysis.



Q 27: Discuss endocytosis and exocytosis?

1. Endocytosis:-

Definition:-

The movement of materials from outside environment to inside the cell is called endocytosis.

Endocytosis occur in following steps,

- A portion of cell membrane invaginates (depressed inward)
- The material from outside is taken inside the invagination.
- The open ends of the invagination seal and form a small vesicle.
- 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:-

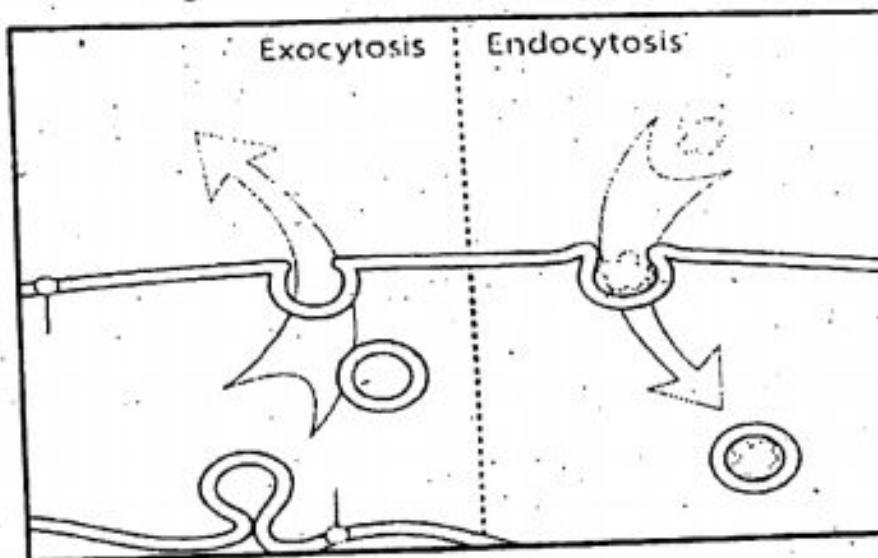
The endocytosis of liquid substances is called Pinocytosis. It is also called drinking of a cell.

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.
- iii. 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.

**Q 28: 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 or 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 waste materials.

Q 29: Define tissue? Discuss various types of plant tissues?**Tissue:-**

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

Types of Plant Tissues:-

There are two types of plant tissue.

1. Simple tissue.
2. Compound tissue.

1. Simple tissues:-**Definition:-**

The tissue which are 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, stems 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 growth is called primary growth.

2. Lateral meristems:-

These are located on the lateral sides of roots and shoot. By dividing 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. Cells of the epidermal tissues 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 tissues 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 a thick waxy layer which prevents transpiration.

Root:-

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

2. Ground tissues:-**Location:-**

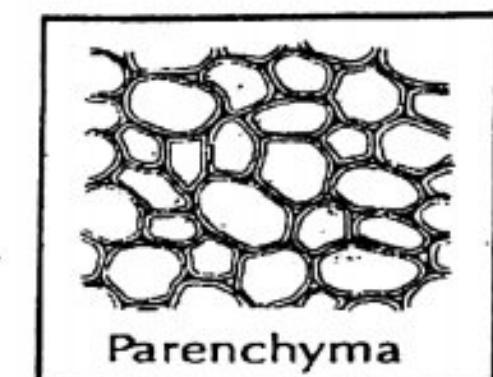
They are present in all parts of plant except epidermal and vascular tissues.

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 to presence of large vacuole.
- iv. In leaves, the ground tissue contains chlorophyll and is called mesophyll tissue. 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 ends.

Location:-

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

Function:-

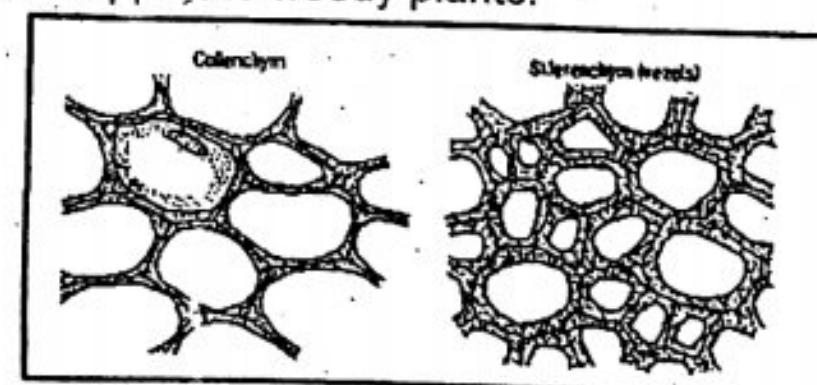
They provide strength to different parts of the plant.

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

They are thick walled dead cells. Their cell walls have 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 cell 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 consists 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:-

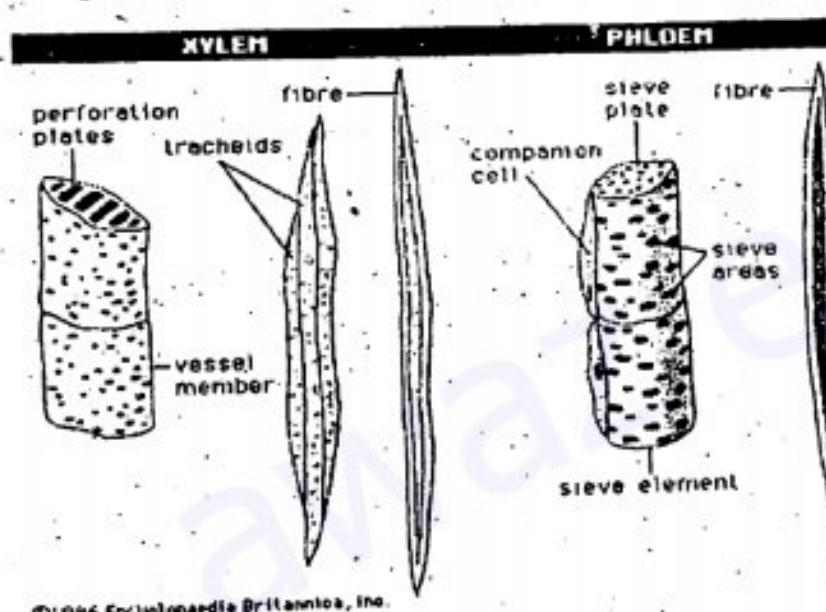
They transport prepared food.

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.

Q 30: Discuss different type of animal tissues?**Ans: Animal Tissue:-**

Animal tissues are classified according to their structure and function into major four types.

1. Epithelial tissue:-

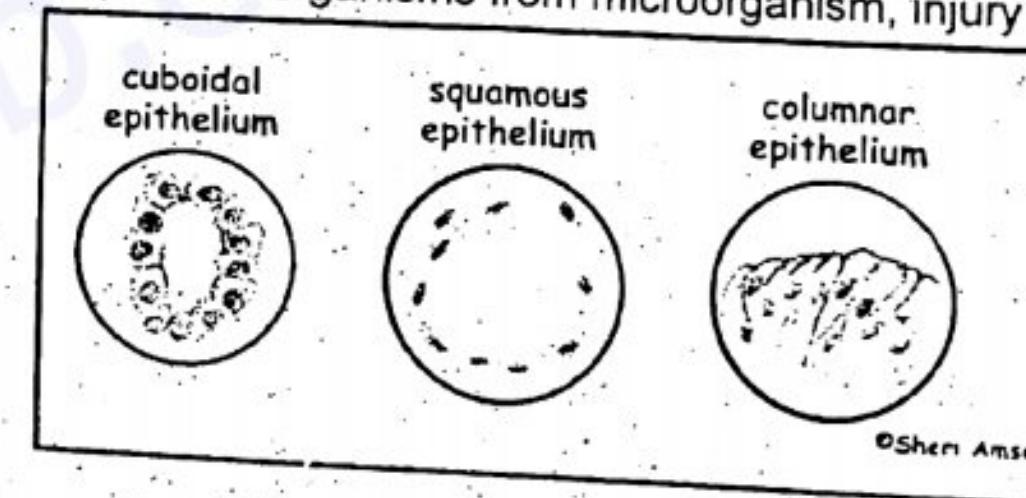
Epithelial tissue are made from epithelium cells they form the outermost layer of skin.

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 includes,

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

Consists 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 esophagus, mouth and at the surface of skin.

2. Connective tissue:

As the name implies, connective tissues serve "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 organs.

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 vertebrae, as skeleton in many fishes.

v. Bone:

- Matrix contains collagen fibers embedded in calcium salts
- Supports, protects, provide lever system 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 substances 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:

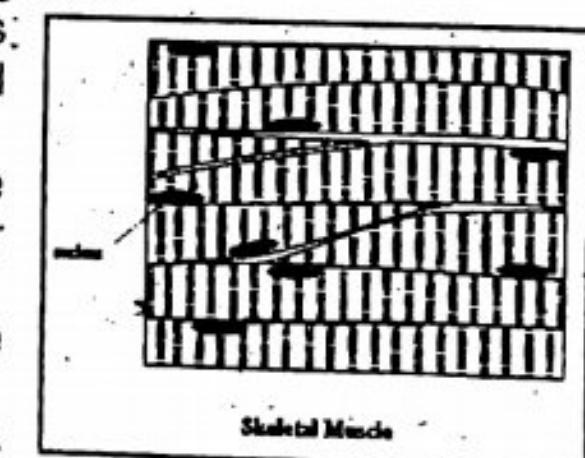
There are three types of muscle in vertebrates.

- i. Skeletal muscle.
- ii. Smooth muscle
- iii. Cardiac muscle.

i. Skeletal muscle:

The characteristics of skeletal muscles are,

- Skeletal muscles are attached to our bones and cause movement in them. i.e., movement of arms and legs etc.
- These are striated or striped 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.



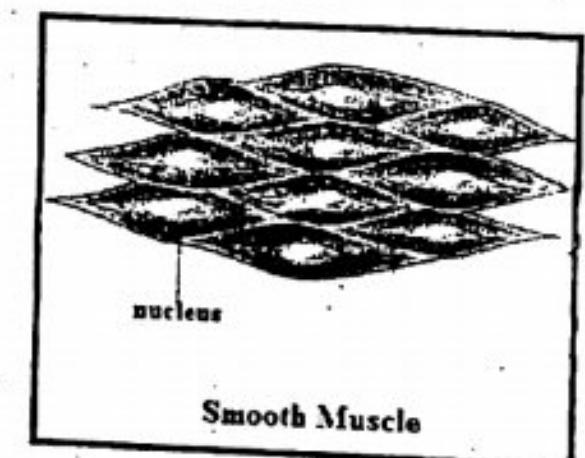
Skeletal Muscle

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.



Smooth Muscle

- ✓ These are non-striated or striped muscle because they have no alternate light and dark bands.
- ✓ Fibers of smooth muscles are uninucleated.
- ✓ 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. There are two type of nervous system:

- ✓ Central nervous system
- ✓ Peripheral nervous system

Central nervous system:-

Central nervous system is composed of brain and spinal cord.

Peripheral nervous system:-

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

Q 31 : Difference between plant cell and animal cell?

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.

EXERCISE**MULTIPLE CHOICE QUESTIONS****A. Encircle the best suitable answers.**

1. Schleiden and Schwann proposed the cell theory on the basis of
 - (a) Their observation
 - (b) Observation of Hooke and brown
 - (c) All observation on the cell
 - (d) Observation made on the nucleus of the cell
2. The organelle which provides energy to the cell:
 - (a) Golgi apparatus
 - (b) Ribosome
 - (c) Mitochondria
 - (d) Nucleus
3. We obtain 2D images through
 - (a) Light microscope and SEM
 - (b) SEM and TEM
 - (c) Light microscope and TEM
 - (d) Light microscope
4. Inside the nucleus, granular material is called:
 - (a) Cytoplasm
 - (b) Protoplast
 - (c) Nucleoplasm
 - (d) called sap
5. The organelle involved in protein synthesis is :
 - (a) Ribosome
 - (b) vacuole
 - (c) Golgi apparatus
 - (d) plastids
6. The nervous tissue has the ability to :
 - (a) Contract and relax
 - (b) transmit the impulses
 - (c) prepare secretion
 - (d) provide energy
7. In plants, which tissue makes new cells?
 - (a) Meristematic tissue
 - (b) collenchyma tissue
 - (c) epidermal tissue
 - (d) ground tissue
8. Movement of molecules from lower to higher concentration with the expenditure of energy is:
 - (a) Diffusion
 - (b) active transport
 - (c) facilitated transport
 - (d) osmosis
9. One of the following has both cytoplasm and cell wall:
 - (a) Muscle cell
 - (b) red blood cell
 - (c) root hair cell
 - (d) xylem vessel
10. Cell membrane is made of
 - (a) Cellulose only
 - (b) lipids only
 - (c) lipids only
 - (d) lipids and proteins

SHORT QUESTIONS

B: Write short Answer of the Following Questions.

Q-1: Who proposed the cell theory and what are the main points of the cell theory?

Ans: See Q No.8

Q 2: Differentiate between simple and compound tissue?

Ans: Simple and compound tissues:

NO	Simple tissues	Compound tissues
1	Those tissues which are composed of same kind of cells are called simple tissues	Those tissues which are composed of different kinds of cells are called compound tissues.
2	Simple tissue in plants are responsible for forming protective covering like epidermal tissue.	Compound tissue in plants are involved in the conduction of water like xylem.
3	Some are involve in growth like meristematic tissue.	some are involve in the distribution of food like phloem.
4	Some simple tissue are supportive in nature like supporting tissue (collenchymas & Schlerenchyma)	Some compound tissue are also supportive in nature. Like xylem due to presence of lignin in their secondary walls.
5	Most of tissues in animals are simple tissue	Epithelial tissues in animals are compound.

Q 3. How cell membrane helps in maintaining equilibrium while exchanging 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.

Q 4: Differentiate between endocytosis and exocytosis?

Ans: See Q No.27.

Q 5: How does turgor pressure develops in a plant cell?

Ans: Turgor pressure;

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 increase 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 to change in turgor pressure.
 - iv. It gives proper shape to the cell.

LONG QUESTIONS

C. Give detailed Answers to the following Questions.

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

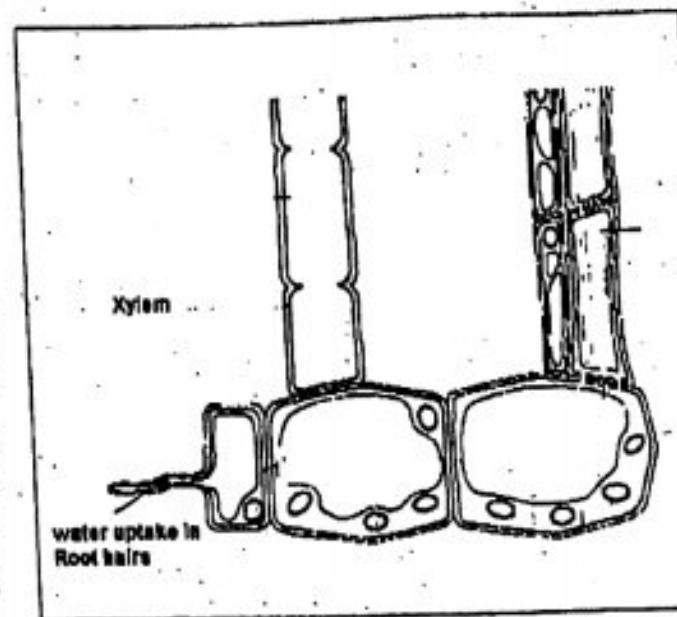
Ans: Absorption of Root hairs:

Absorption of Root hairs:
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 salts must move through the epidermis and cortex of the root, and then into the xylem tissue in the centre of the root.

Xylem role In support:

Xylem also help in the support of plant body because xylem contains fibers. Fibers are elongate 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.



Q 2: Discuss different types of tissue found in plants. Elaborate your answer with relevant diagrams?

Ans: See Q No. 29

Q 3: Describe the nervous, muscular and epithelial tissues?

Ans: See Q No. 30

Q 4: 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)

ADDITIONAL MULTIPLE CHOICE QUESTIONS

- 1) The first microscope was developed by
 a) Zaccharias Janssen b) Dolland
 c) Hans Janssen d) Both A & C
- 2) Who was the first man to discover microorganism
 a) Zaccharias Janssen b) Dolland
 c) Leeuwenhoek d) Hans Janseen
- 3) The first microscope was developed in Holland in
 a) 1595 b) 1559
 c) 1599 d) 1597
- 4) The resolution of human eye
 a) 0.1 mm b) 0.2 mm
 c) 0.3 mm d) 0.4 mm
- 5) The magnification of light microscope is
 a) 1200 X b) 1300X
 c) 1500 X d) 1700 X
- 6) The resolving power of electron microscope is
 a) 0.1 um b) 0.2mm
 c) 0.2 nm d) 0.2 um
- 7) We obtain 3 D images through
 a) SEM b) light microscope
 c) TEM d) none of these
- 8) Who discovered cell.
 a) Robert brown b) Robert Hooke
 c) Ronald Ross d) Robert Koch
- 9) Robert hooke discovered the cell in
 a) 1665 b) 1656
 c) 1565 d) 1556
- 10) More than _____ million patients tested by microscope examination 2016.
 a) 100 million b) 150 million
 c) 200 million d) 204 million
- 11) Who discovered the nucleus?
 a) Robert Hooke b) Robert Brown
 c) Lamarck d) Mandel

- 12) A British botanist Robert Brown discovered the nucleus in
a) 1831 b) 1835
c) 1840 d) 1845

13) The soluble part of cytoplasm has _____ % water
a) 60 % b) 65 %
c) 70 % d) 75 %

14) The most acceptable model about the structure of cell membrane
a) Fluid mosaic model b) plant cell
c) animal cell d) all of these

15) Which transport materials in cell
a) ribosome b) endoplasm reticulum
c) plastid d) mitochondria

16) In _____ Golgi was awarded noble prize for physiology and medicine
a) 1902 b) 1904
c) 1906 d) 1908

17) Mitochondria are absent in _____
a) Plant cell b) animals cell
c) bacteria cell d) none of them

18) Power house of cell is
a) Centriole b) Golgi bodies
c) Ribosome d) Mitochondria

19) The organelle involved in protein synthesis is
a) Ribosome b) vacuole
c) Mitochondria d) plastid

20) The organelle which are found in both prokaryotes and eukaryote are
a) Vacuole b) mitochondria
c) Ribosomes d) plastid

21) Plastid are found in
a) Plants b) photosynthetic Protista
c) Animals d) Both A & B

22) Photosynthesis take place in
a) Chloroplast b) leucoplast
c) chromoplast d) mitochondria

23) Which is involved in formation of cilia and flagella
a) Mitochondria b) ribosome
c) Centriole d) lysosomes

- 24) Which one of the following have their own DNA
a) Mitochondria b) chloroplast
c) Nucleus d) all of these

25) Mitochondria have their own
a) Ribosomes b) nucleus
c) DNA d) Both A & C

26) The organelles involved in chromosomes movement during cell division
a) Ribosomes b) plastid
c) Centrioles d) mitochondria

27) The membrane of vacuole is called
a) Cell membrane b) tonoplast
c) Leucoplast d) cell wall.

28) The number of chromosome in Human cell is
a) 46 b) 48
c) 50 d) 52

29) The number of chromosome in Reddish is
a) 18 b) 20
c) 22 d) 24

30) The number of chromosome in onion is
a) 14 b) 16
c) 18 d) 20

31) Eating process of cell is called
a) Diffusion b) Phagocytosis
c) Osmosis d) pinocytosis

32) Drinking of a cell is
a) Diffusion b) phagocytosis
c) Osmosis d) pinocytosis

33) The skin is made of _____ tissues.
a) Epithelial b) connective
c) Muscular d) nervous

34) Muscles attach to bones through
a) Ligaments b) tendons
c) Cartilage d) fibers

35) The muscle of the heart are called
a) Smooth muscle b) skeletal muscle
c) cardiac muscle d) Both A & B

THE TERMS TO KNOW

Microscopy	Microtubules	Biconvex
Magnification	Cilia	Turgid
Resolution	Flagella	Flaccid
Resolving power	Centrosome	Adipose tissue
2 D,3 D	Centromere	Nerve impulse
Peptidoglycan	biconcave	Mesophyll tissue

Chapter No.5

Cell Cycle

Q 1: What is cell cycle? Describe various phases of interphase of cell cycle with diagram.

Ans: Cell cycle:

The series 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 phases of interphase:

Interphase has three sub phases.

i.G₁ – 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 G₁ phase.

ii. S-Phase (S- Synthesis):

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 becomes duplicated and the cell become ready to enter the next phase called G₂- Phase.

III. G₂-Phase:

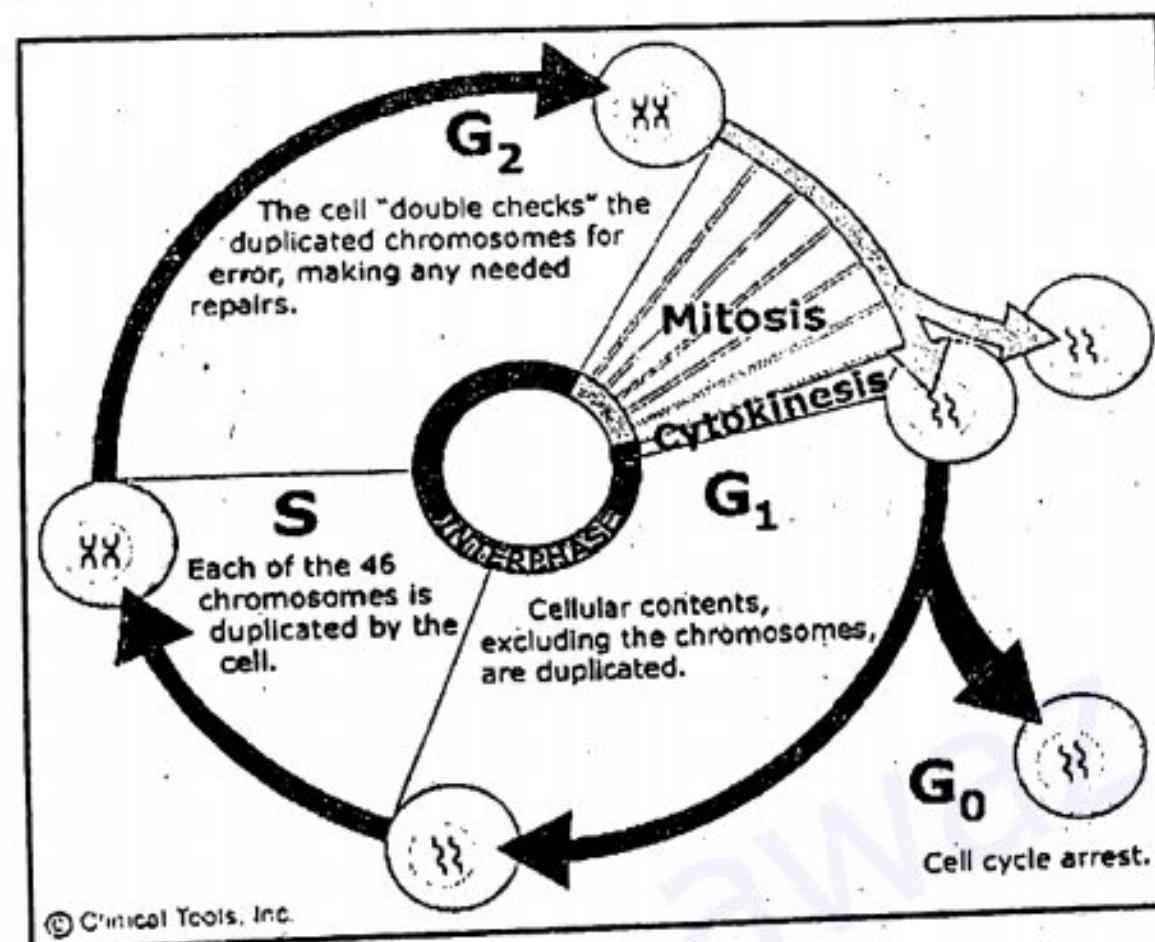
The gap between the end of S-Phase and the start of M-Phase is called G₂ phase.

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 indicate the end of interphase.

G₀-Phase:

Cells that have temporarily or permanently stopped dividing called G₀-phase.



Q 2: Define Mitosis? Describe various stages of mitosis in detail?

Mitosis:**History:**

A German Biologist Walther Flemming 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 series of changes which he called mitosis.

Definition:

The type of cell division during which a single parent cell divides into two daughter cells and each daughter cell receive the same number and same kind of chromosomes from the parent cell is 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" mean 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:**

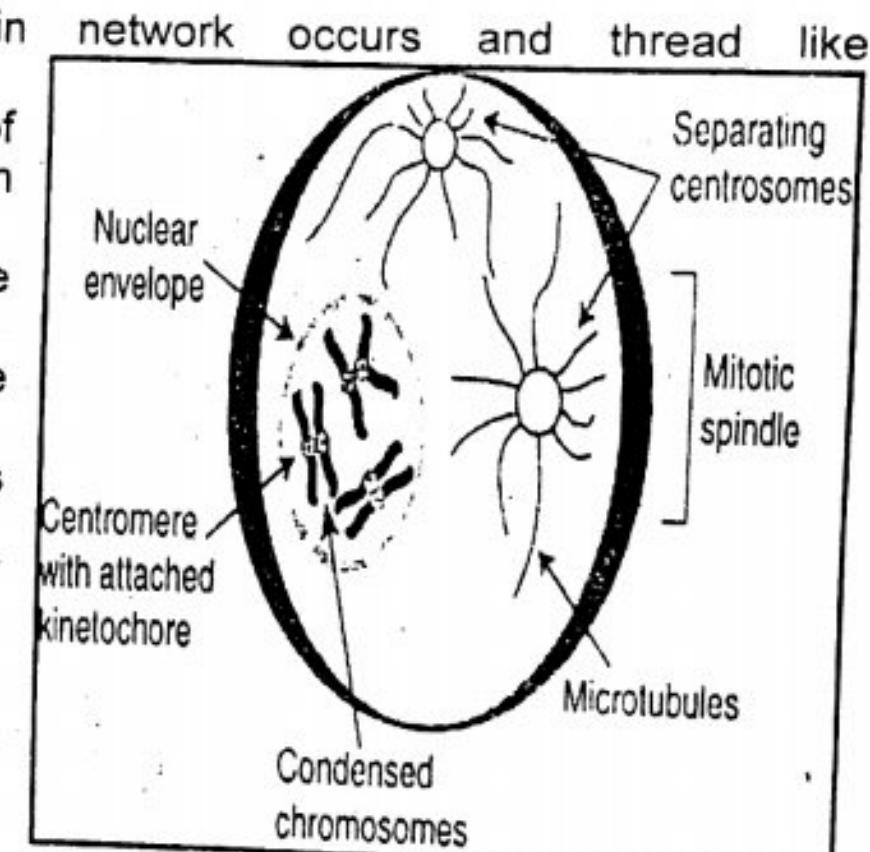
- i. Condensation of chromatin chromosomes appear.
- ii. Each chromosome consists of two chromatids attached with each other at centromere.
- iii. Nuclear membrane disappears.
- iv. Centrioles move to the opposite poles.
- v. Three sets of spindle fibers arise from each centriole.

a. Astral microtubules: Astral microtubules radiate outward and form star shaped structure called aster.

b. Kinetochore Microtubules:

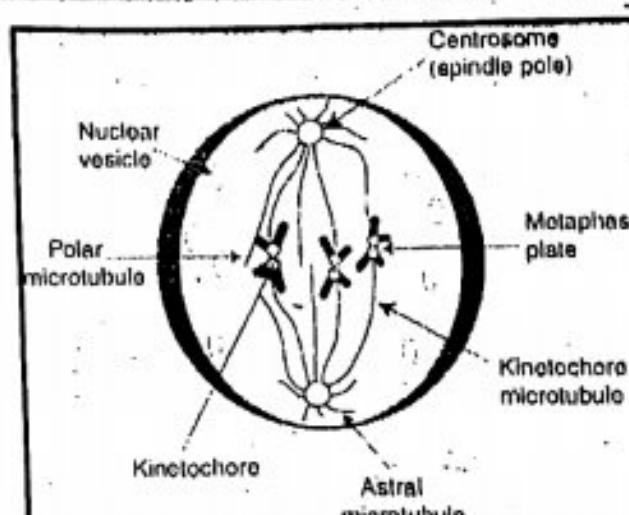
Kinetochore microtubules are attached to the kinetochore (structural protein present on chromosome) of chromosome.

C. Polar microtubules: Polar microtubule arises from one pole and come in contact with the microtubules of other poles.

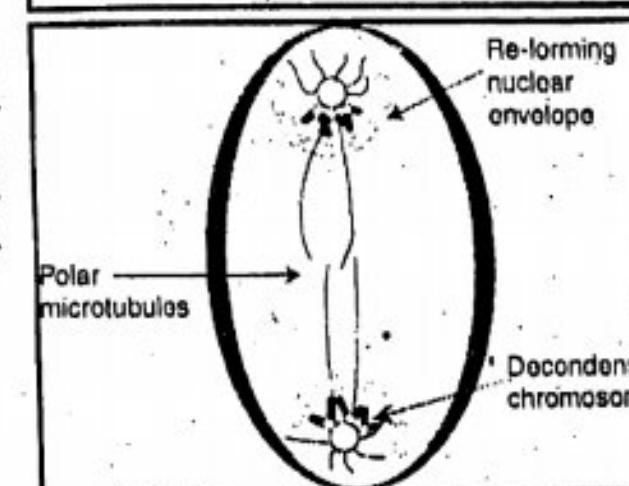


II. Metaphase:**Main events:**

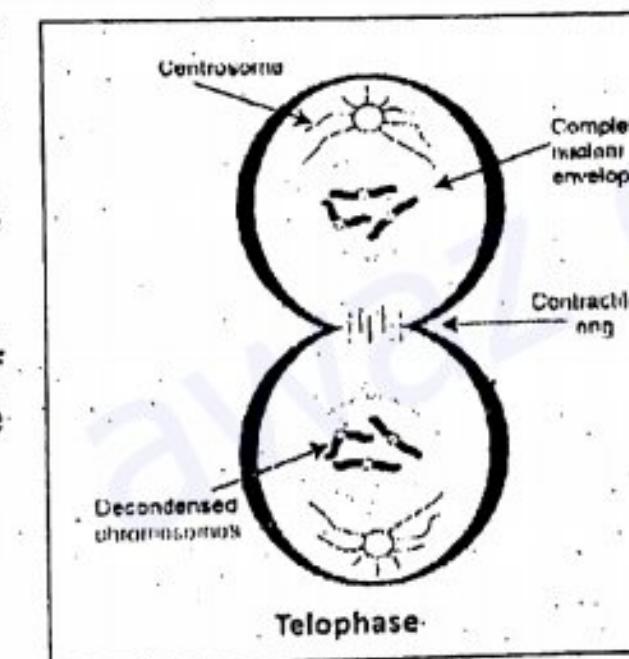
- During this phase chromosomes arranged itself at the centre of cell to form line of chromosome called metaphase plate or equatorial plate.
- Two spindle fibers from both side attach with one chromosome.

**III. Anaphase:****Main events:**

- The centromere of each chromosome splits into two parts.
- The spindle fibers contract and they pull the chromatids (daughter chromosomes) towards their respective pole.
- Cytokinesis begins in anaphase.

**VI. Telophase:****Main events:**

- In telophase, spindle fibers breakdown.
- Chromosomes reach to the respective pole.
- Chromosomes uncoil to become thin chromatin networks.
- Two daughter nuclei are formed, each with the same number of chromosome as were present in the parent nucleus.



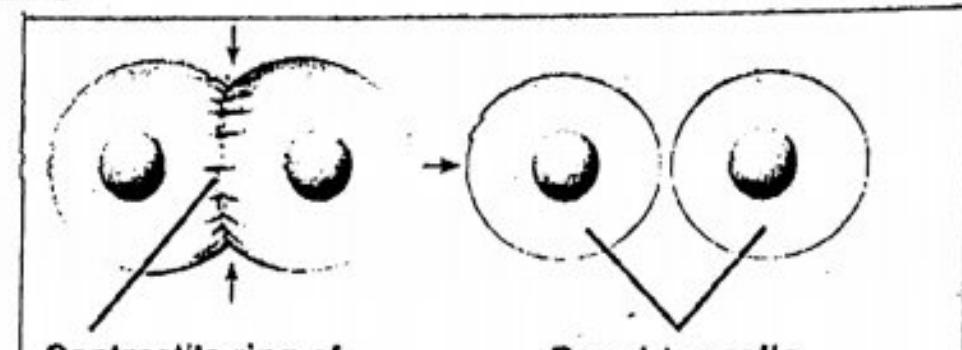
Q 3: Define Cytokinesis? Write the mechanism of cytokinesis in animal and plant cells?

Ans: Cytokinesis:

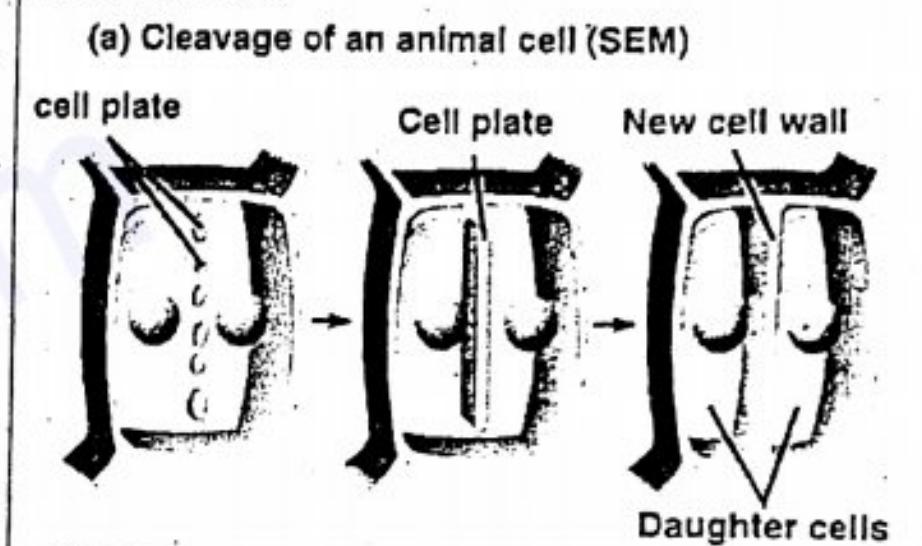
The division of cytoplasm is called cytokinesis.

Cytokinesis in animal's cell:**Mechanism:**

The plasma membrane in the centre 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 outward 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.

**Q 4: 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 an 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 organism have the ability to regenerate the whole body from a piece of the body, e.g. hydra, star fish, Earthworm.

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 reproduction in plants occurs due to mitosis.

Example:

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

Q 5: Define Meiosis? Write the various stages of Meiosis.

Meiosis:

History:

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

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 numbers 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 I 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 form pairs. The pairing 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. Homologous chromosomes separate and move toward opposite poles of the cell.
- iii. One haploid set of chromosome is formed at each pole.

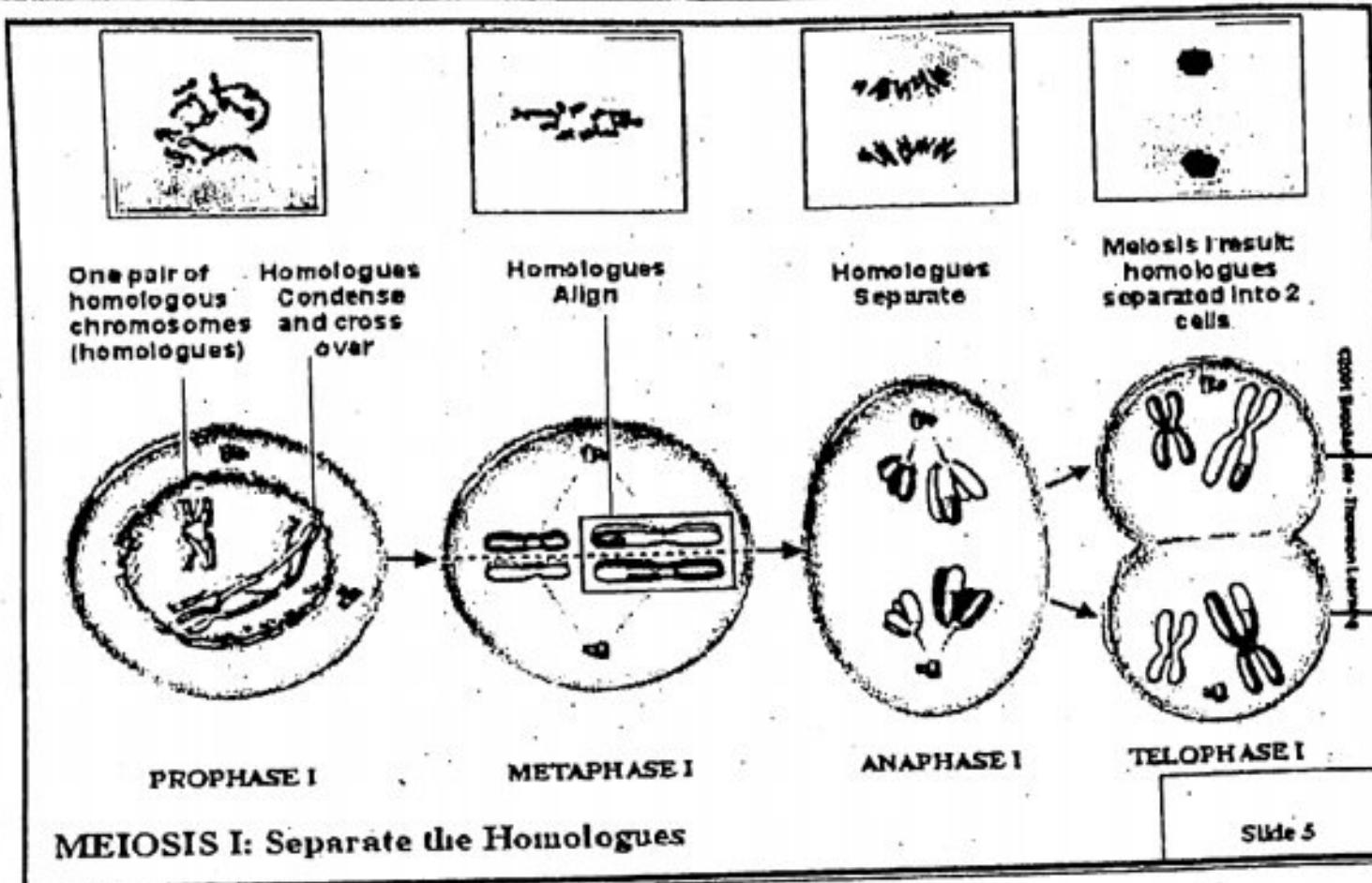
Telophase I:

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 differ 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.
- Nuclear membrane disappears.

ii. Metaphase II:

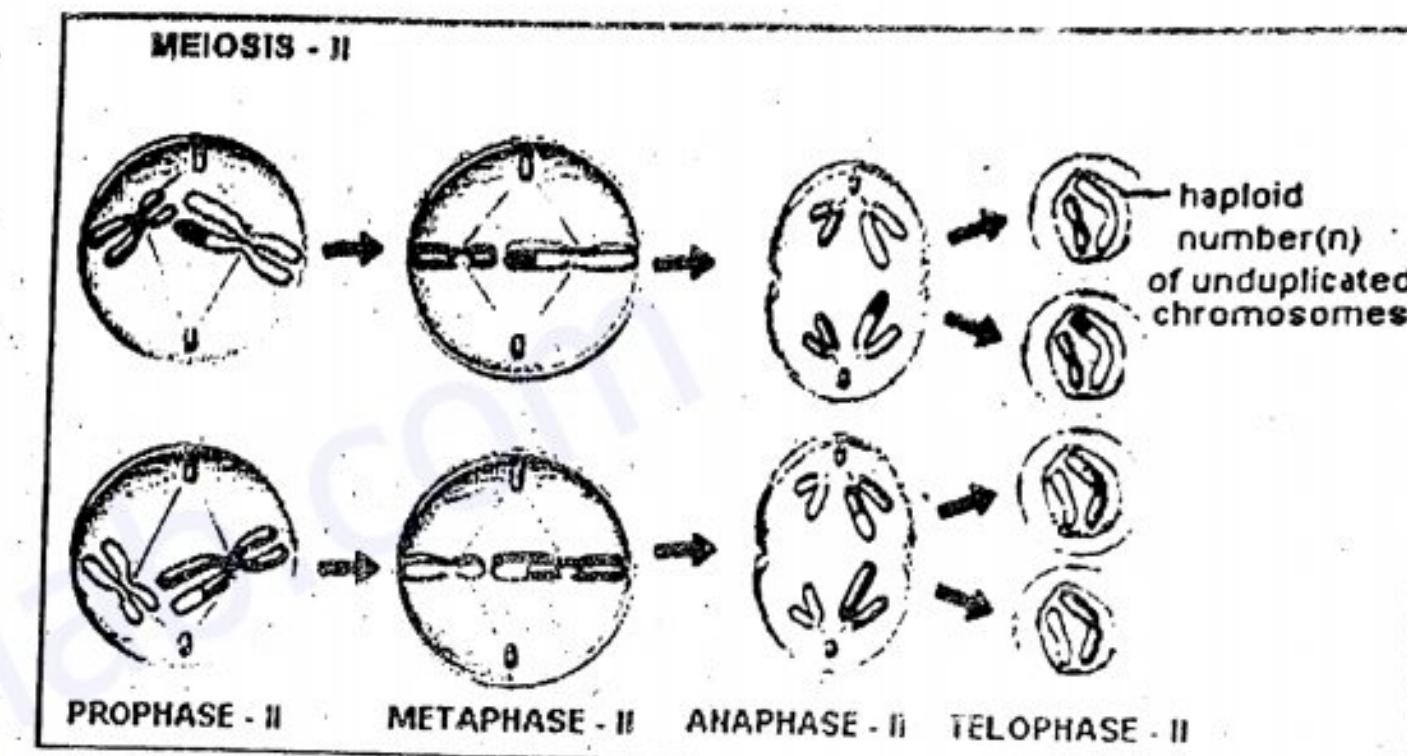
- Chromosome form a line in the center of cell called metaphase plate or equatorial plate.

iii. Anaphase II:

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

iv. Telophase II:

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



Q. 6: What are 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 diploid plants, the spore-mother cells undergo meiosis to make haploid spores. These spores grow into haploid structure which produces haploid gametes by mitosis. The haploid gametes combine to produce the diploid zygote. The zygote undergoes repeated mitosis to become the diploid plants. This process is called alternation of generation.

3- Maintain constant number of chromosome:

Meiosis maintains constant number of chromosome 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.

Q 7: Write note on apoptosis and Necrosis?**Ans. i. Apoptosis:**

Apoptosis is also called programmed cell death (PCD).

Mechanism:

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

Example:

- Disappearance of tadpole tail during metamorphosis.
- Disappearance of web present in human hand and formation of fingers.
- 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.

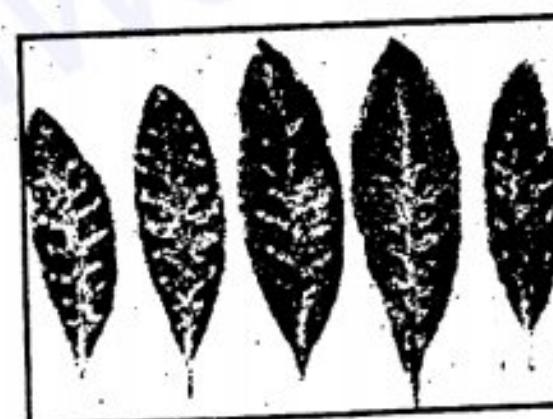
Mechanism:

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 cause necrosis are

- Radiation
- Heat
- Trauma
- Lack of oxygen
- Blockage of blood flow etc.

**EXERCISE****MULTIPLE CHOICE QUESTIONS****A. Encircle the best suitable answers**

- All of the following is true for meiosis, except :
 - There is no DNA synthesis between the divisions
 - The result is four cells with haploid number of chromosomes
 - Meiosis does not contribute to the genetic diversity in populations**
 - Fusion of two products of meiosis produces a zygote
- If $2n = 8$, for a particular cell, then the chromosome number in egg cell after meiosis would be
 - 12
 - 10
 - 8
 - 4
- During which stage of meiosis does the chromosome have the least amount of DNA?
 - Prophase-I
 - prophase-II
 - telophase-I
 - telophase-II
- Which statement concerning both mitosis and meiosis is correct?
 - Meiosis produces 4 haploid cells while mitosis produces 2 diploid cells.**
 - Meiosis produces 4 diploid cells while mitosis produces 2 haploid cells
 - Meiosis maintains the number of chromosomes, while mitosis reduces it
 - Prophase-I of mitosis results in the formation of a tetrad but not in prophase-I of meiosis-I
- During which phase of meiosis, crossing over occurs?
 - Prophase -I
 - metaphase - I
 - metaphase - II
 - Anaphase - I
- Which of the following occurs during meiosis - I but not during mitosis?
 - The chromatids of each chromosome are separated
 - Synapsis and crossing over occurs**
 - The nuclear envelope breaks down
- Meiosis takes place in which of the following organs?
 - Testes
 - lungs
 - heart
 - stomach

SHORT QUESTIONS

B. Give Short Answers to the following Questions?

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

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

L. Interphase:

It is further divided into three sub-phases

- It is further divided into three sub phases.

 - i. **G₁- Phase:** In this phase cellular organelles produce.
 - ii. **S- Phase :** In this phase DNA replication occur.
 - iii. **G₂- Phase :** In this phase spindle fiber form.

II. Division phase:

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

 - i. Prophase: Disappearing of nuclear membrane.
 - ii. Metaphase: Arrangement of chromosomes at cell outer edge.
 - iii. Anaphase : Separation of chromatids
 - iv. Telophase: Reappearing of nuclear membrane.

Q. 2. In which type of cell, meiosis take place and why it is important?

Ans: Occurrence of meiosis

Occurrence of Meiosis Meiosis takes place in germ cells or gametes.

Importance:

- i) It involves reduction in numbers of chromosomes.

- ii. This helps to maintain the chromosome number constant generation after generation.
 - iii. Reshuffling of genetic material takes place during crossing over in meiosis that leads to variation and serve as raw material for evolution.

Q.3 : 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 takes 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 some animals and vegetative reproduction in plants occurs by mitosis.

Q 8: Give at least four differences between mitosis and meiosis?

Ans: Difference between mitosis and meiosis:

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

Q 5: What is chiasma and what is its role in crossing over?

Ans; Chiasma:

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

Importance:

At chiasma, the non-sister chromatids of homologous chromosomes exchange their parts. This process is called crossing over, which result in genetic variation and as well as phenotypic variation in sibling.

LONG QUESTIONS

C. Give detailed answers to the following questions.

Q 1: Describe various phases of interphase of cell cycle with diagrams.

Ans: See Q No. 1

Q 2: Discuss different events of Meiosis-I with the help of diagram?

Ans: See Q No. 5

Q 3: Explain different stages of mitosis with diagrams and at what stage, cytokinesis take place?

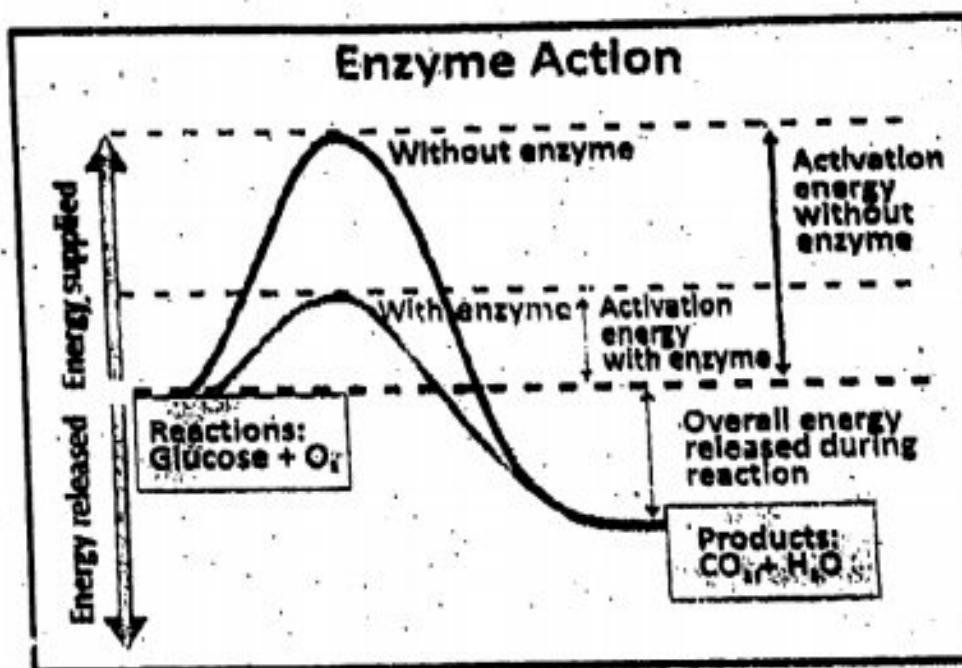
Ans: See Q No. 2

ADDITIONAL MULTIPLE CHOICE QUESTIONS

- 1) The series of events that take place in Eukaryotic cell leading to it replication is called
a. Cell cycle b. cell division c. mitosis d. Meiosis
- 2) The longest subdivision of interphase is
a. G₁- phase b. S-Phase c. G₂- phase d. G₀- phase
- 3) RNA ribosome and several enzymes are formed in
a. G₁- phase b. S-Phase c. G₂- phase d. G₀- phase
- 4) Replication of DNA occurs in
a. G₁- phase b. S-Phase c. G₂- phase d. G₀- phase
- 5) Each chromosome is consisting of how many chromatids?
a. Two b. four c. six d. eight
- 6) The cells which do not enter in G₀-Phase and continuously divide throughout life is called

- a. neurons b. liver cells c. Epithelial cells d. both A and B
- 7) The final events occur in Interphase
a. Replication of DNA b. synthesis of RNA
c. chromosomes replication d. Replication of centrioles
- 8) Mitosis takes place in
a. Eukaryote cells b. prokaryotic cell c. Both A & B d. none
- 9) Binary fission takes place in
a. Eukaryotic cell b. Prokaryotic cell c. frog cell d. earthworm
- 10) In mitosis the cell divide into daughter cells
a. Two b. four c. six d. eight
- 11) Mitosis take place in
a. somatic cell b. body cell c. germ cells d. Both A & B
- 12) Daughter cells receive same number of chromosome in
a. Mitosis b. meiosis c. cytokinesis d. interphase
- 13) The division of nucleus is called
a. cytokinesis b. S-phase c. Karyokinesis d. both A & B
- 14) In animal cell, the two pairs of centriols reach opposite pole of the cell in _____ phase of cell cycle.
a. metaphase b. early prophase c. Late prophase d. anaphase
- 15) equatorial plate is formed in
a. prophase b. Metaphase c. anaphase d. telophase
- 16) The cell membrane began to move inward at the centre in.
a. early prophase b. Late prophase c. early anaphase d. Late anaphase
- 17) Two daughter nuclei are formed in
a. prophase b. metaphase c. anaphase d. Telophase
- 18) In animals cell cytokinesis occurs due to
a. cell plate b. infolding of cell membrane
c. both A and B d. none of these
- 19) In plant cell cytokinesis occurs due to
a. Cell plate b. infolding of cell membrane
c. both a and b d. none of these
- 20) Mitosis play significant role in the
a. Growth b. repair of worn-out parts.
c. asexual reproduction d. All of these
- 21) Hydra reproduce asexually by
a. Fragmentation b. spore formation
c. Budding d. binary fission
- 22) In meiosis _____ daughter cells are formed.
a. two b. Four c. six d. eight

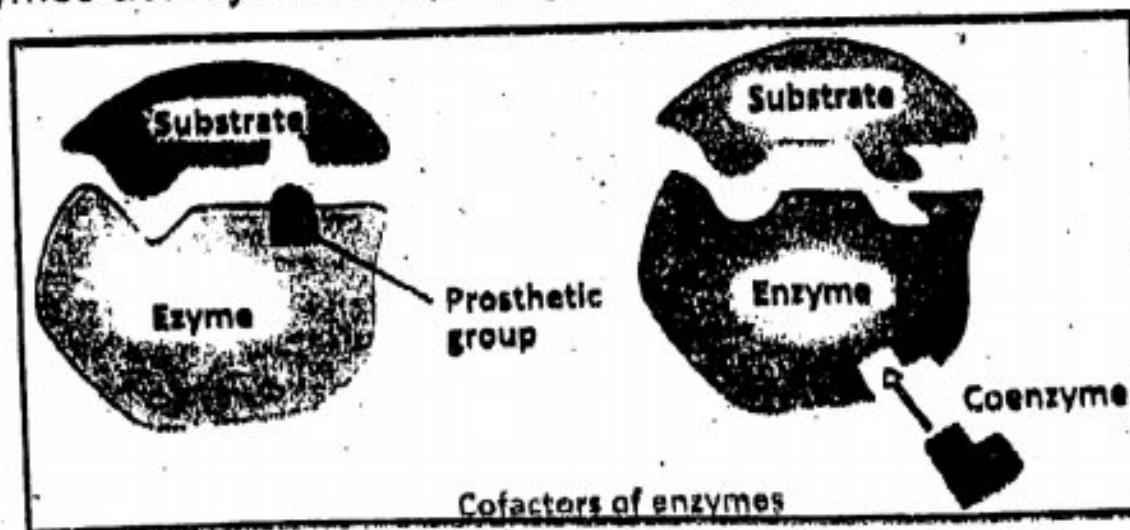
- ii. Disrupting the charge distribution.
- iii. Bringing substrates in the correct orientation to react.



Q 3: 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 work outside the cell are called extracellular enzymes like pepsin work in stomach.
- viii. Enzymes activity can also be regulated by inhibitor and activators.



Q 4: Define the following terms?

Ans: Activators:

Substances which increase 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 e.g. riboflavin, thiamine, folic acid.

Prosthetic group: If 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:

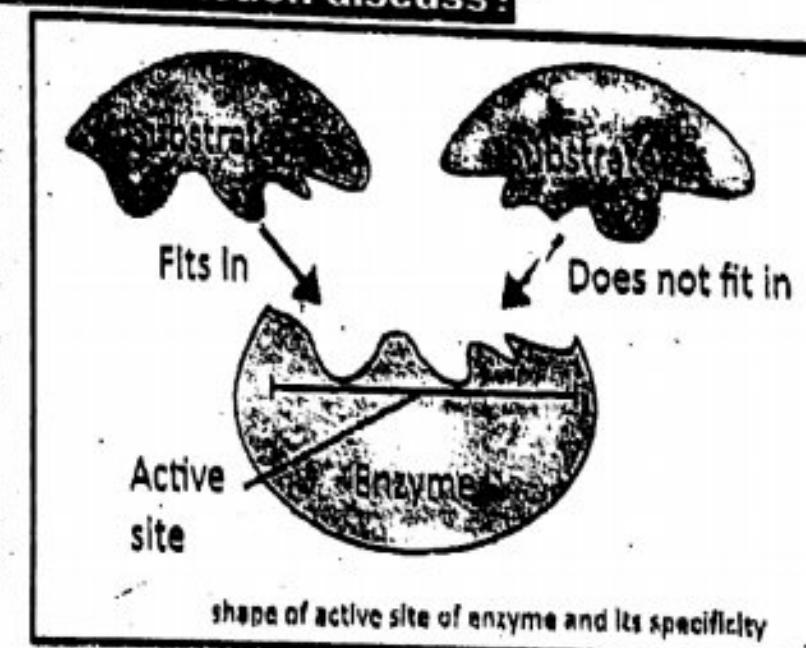
A region on an enzyme where substrate binds during reaction is called active site.

Activation energy:

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

Q 5: 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.

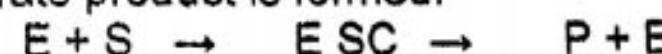


Example:

Urea	$\xrightarrow{\text{Urease}}$	Ammonia
Starch	$\xrightarrow{\text{Amylase}}$	Glucose
Protein	$\xrightarrow{\text{Protease}}$	Amino acid
Lipid	$\xrightarrow{\text{lipase}}$	fatty acid
Cellulose	$\xrightarrow{\text{Cellulase}}$	Glucose

Q 6: Describe the mode of enzyme action?**Ans: Mode of enzyme action:**

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 enzymes and its substrate product is formed.



E = enzyme S = Substrate P = Product

Mechanism of enzyme action:

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

1. lock and key model
2. induced fit Model.

1-Lock and key Model:**History:**

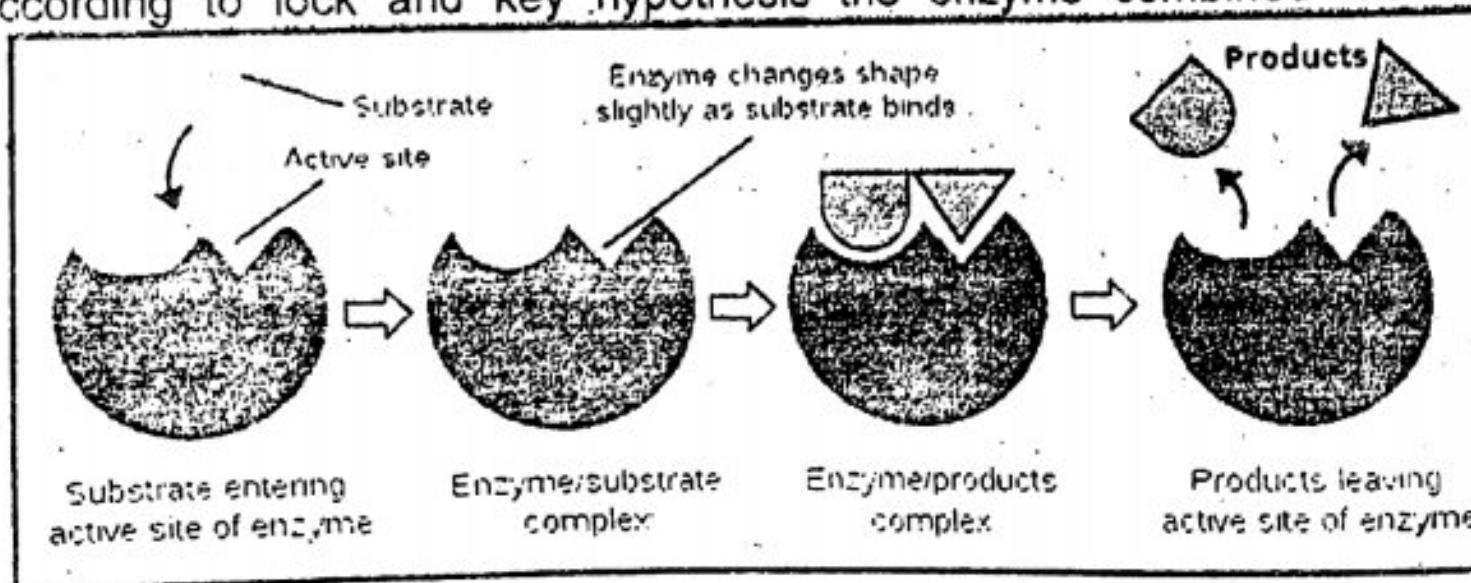
This model was proposed by a German biochemist Emil Fischer in 1894.

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. This model suggests that the active site is a rigid and non-flexible structure.

Mechanism:

According to lock and key hypothesis the enzyme combined with a



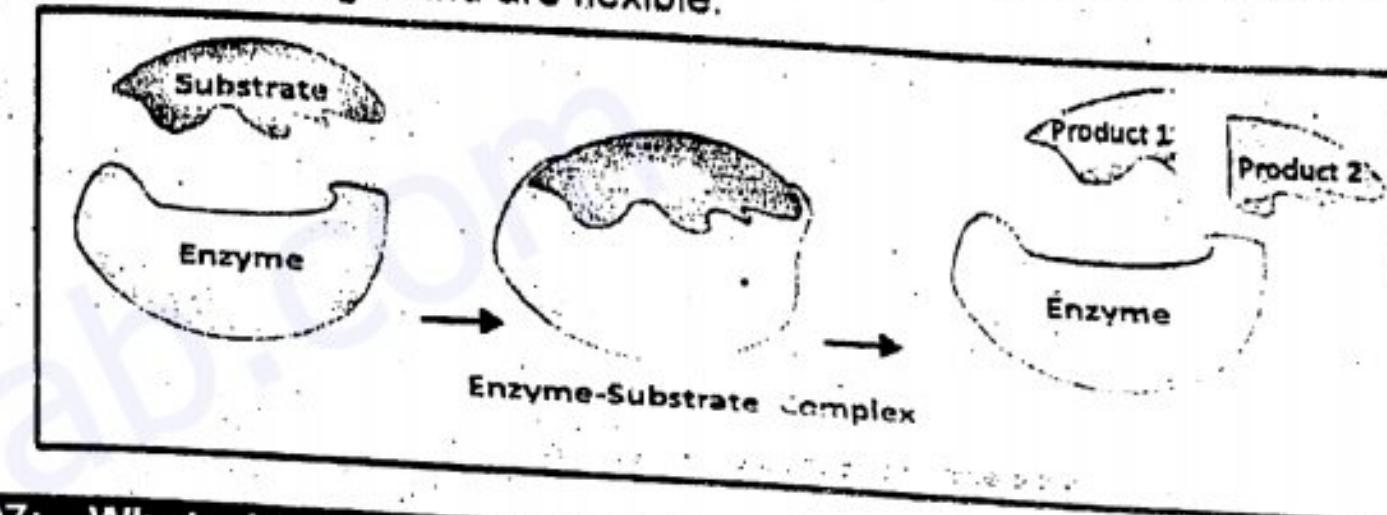
specific substrate and chemically changing the substrate into a new product. No change occurs in the enzyme during or after the reaction.

2-Induced fit model:**History:**

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

Mechanism:

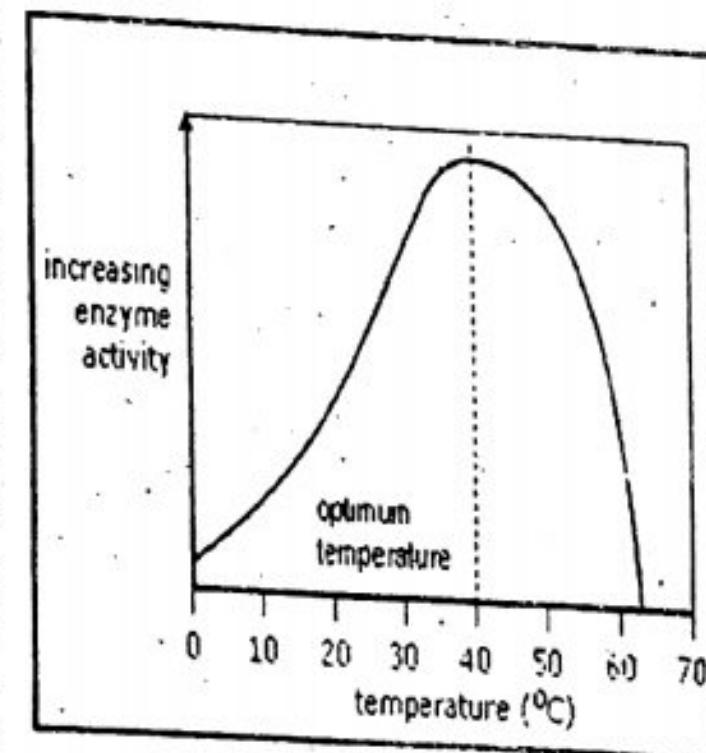
Koshland suggested that when a substrate combines with an enzyme it induces changes in the enzyme structure. This change helps the enzyme to perform its catalytic activity more effectively. So the active sites of the enzymes are not rigid and are flexible.



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

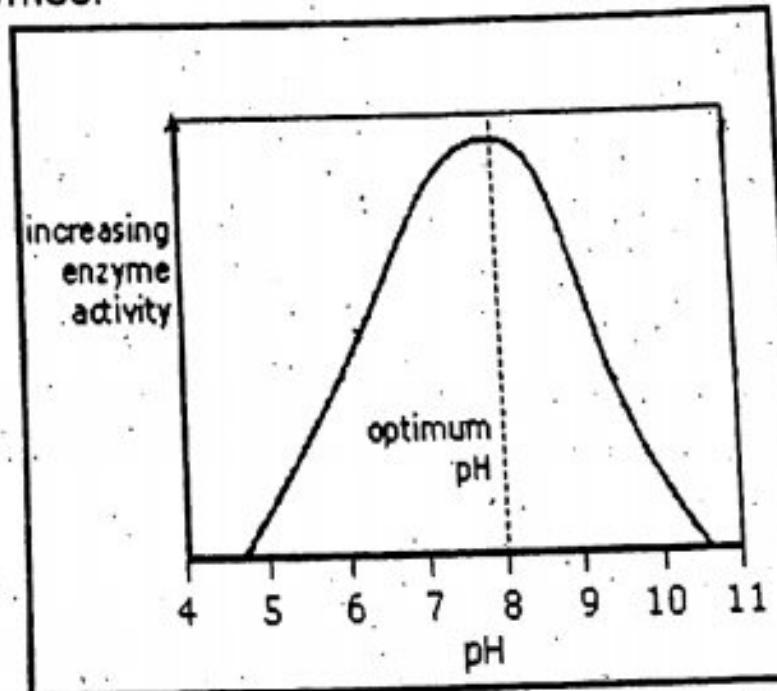
i. Effect of temperature:

Enzymes are very sensitive to the change in temperature. With increase in temperature the enzymes activity also increase but there is limit to the increase. This limit is called optimum temperature (temperature at which enzyme has maximum activity). The (optimum temperature) for human enzyme is between $35 - 40^{\circ}\text{C}$ and the average temperature is 37°C . When temperature is above 40°C the denaturing of enzyme quickly starts. At 0°C the enzyme becomes inactive and cannot perform their function.

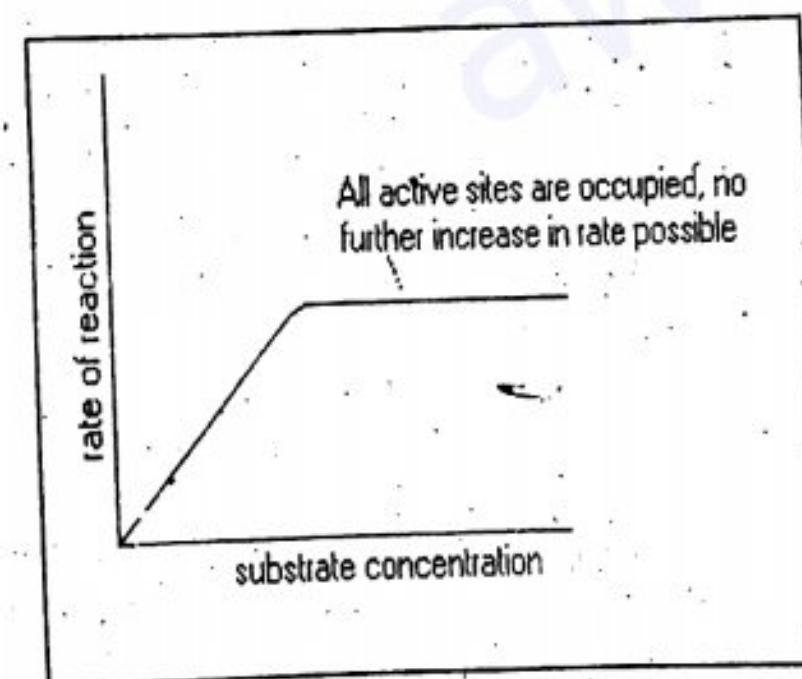


II. Effect of pH:

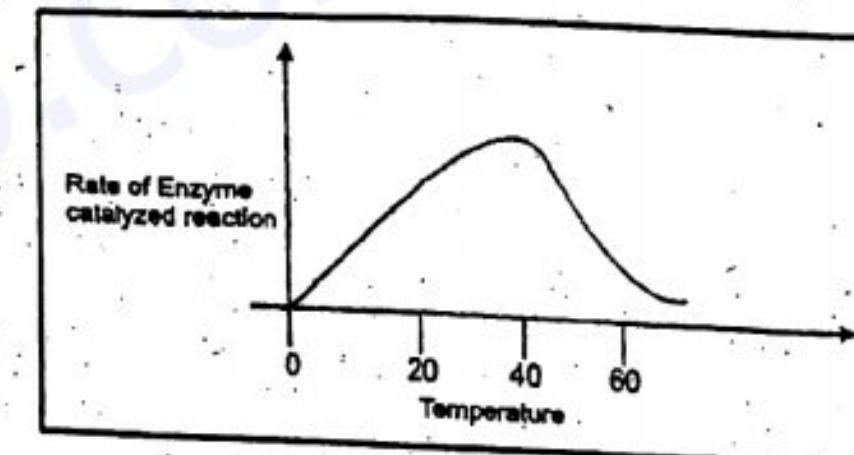
The activity of enzymes varies with change in pH. The pH at which the activity of an enzyme is maximum called optimum pH. Optimum pH value for most enzymes is between 6-8. The activity of enzyme pepsin in stomach work best at a pH of 2 and trypsin at a pH 8. Any change in pH can lower the enzymatic activity. Extreme changes in the pH of solutions denature the enzymes.

**iii. Effect of substrate concentration:**

The rate 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. The speed of reaction will be constant until the substrate is available.

**EXERCISE****MULTIPLE CHOICE QUESTIONS****A. Encircle the best suitable answers**

1. The chemical which are involved as catalysts inside the living bodies are :
(a) Carbohydrates (d) fats (c) Proteins (d) starch
2. Enzymes are biological catalysts which :
(a) Allow new chemical reactions to occur
(b) are used up during chemical reaction
(c) alter the direction of chemical reactions
(d) Alter the rate of chemical reactions
3. The graph below shows that the rate of an enzyme-catalyzed reaction



4. Increases when the temperature is increased
(b) Decreases when the temperature is decreased
(c) Increases with temperature up to a maximum of 40°C.
(d) Remain unchanged
5. What is true about enzymes?
(a) All parts of enzyme molecule take part in reaction
(b) Enzymes lower the activation energy of reaction
(c) An enzyme can act upon any kind of substrates
(d) They are needed in large quantities
6. What is true about cofactors?
(a) Take part in reactions (b) Help enzymes in their activity
(c) Increase activation energy (d) are composed of proteins
7. One of the following may function as coenzymes for the enzymes
(a) Proteins (b) carbohydrates (c) Vitamins (d) DNA

7. Increase or decrease in temperature beyond the optimum temperature will:
 (a) Increase the rate of reaction (b) decrease the rate of reaction
 (c) Not affect the rate of reaction (d) Denature the enzyme
8. Trypsin, an enzymes, works at:
 (a) Alkaline PH (b) Acidic PH (c) Neutral PH (d) PH does not affect
9. Change in environmental facts will affect enzymes activity and therefore, may affect:
 (a) Metabolism (b) respiration (c) Digestion (d) All of them
10. The body temperature at 104°F is known as critical because it causes:
 (a) Nerves breakdown (b) Boiling of body water
 (c) Enzymes stop to work (d) None of the

SHORT QUESTIONS

B. Give short answers to the following Questions.

Q 1: Differentiate between lock and key model and the induced-fit model?

Ans: Difference between Lock and key Model:

Characters	Lock & Key Model	Induced Fit Model
History	This model was proposed by a German biochemist Emil fisher in 1894.	This model was first proposed by American Biologist 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 change 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 change their shape slightly.

Q 2: In what way does an enzyme affect the chemical reactions it catalysis?

Ans: Mechanism of Enzyme action:

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.

Q 3: What will be the effect on digestion if we take some digestive enzymes from outsides?

Ans: Taking of Digestive enzymes from outside:

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 enzymes.

Q 4: What is meant by denaturation of enzymes?

Ans: Denaturation:

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

Enzymes are proteins and denatures quickly at to high temperature. When temperature is raised well above the optimum temperature, the heat energy increases the vibrations of atoms of enzyme molecules and the globular structure of enzymes is lost. This is known as denaturation of enzymes.

Q5: How are enzymes specific for the substrate?

Ans: Enzyme Specificity:

Enzymes are very specific in their action, An enzyme catalyzes 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.

Q 6: What is the term used to describe the temperature and PH at which enzymes can work most effectively in a reaction?

Ans: Optimum Temperature:

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. Optimum temperature for human enzymes is between 35-40 C°.

Optimum PH:

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 QUESTIONS

C. Give detailed answers to the following questions.

Q 1: Describe the factors which affect the enzymes activities?

Ans: See Q No. 7

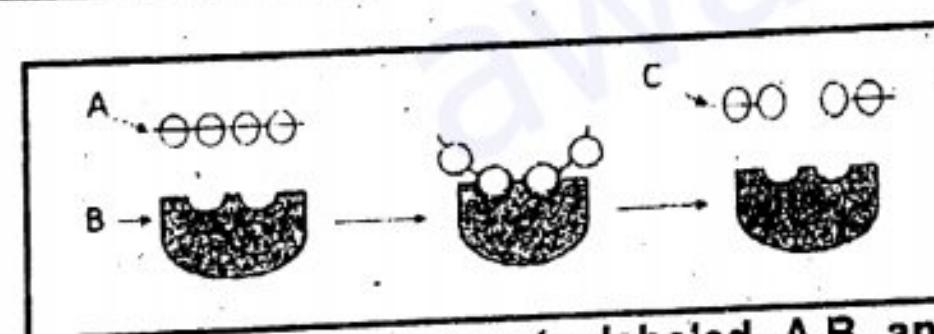
Q 2: Explain the mode of action of an enzyme in a reaction?

Ans: See Q No. 6

Q 3 : What are the various properties of enzymes?

Ans: See Q No. 3

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



a): What is represented by the parts labeled 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 happen to the chemical reaction if the enzyme is removed?

Ans: The enzyme in this diagram shows the active site, enzyme-substrate complex and the enzyme remains 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° o to 60 C°

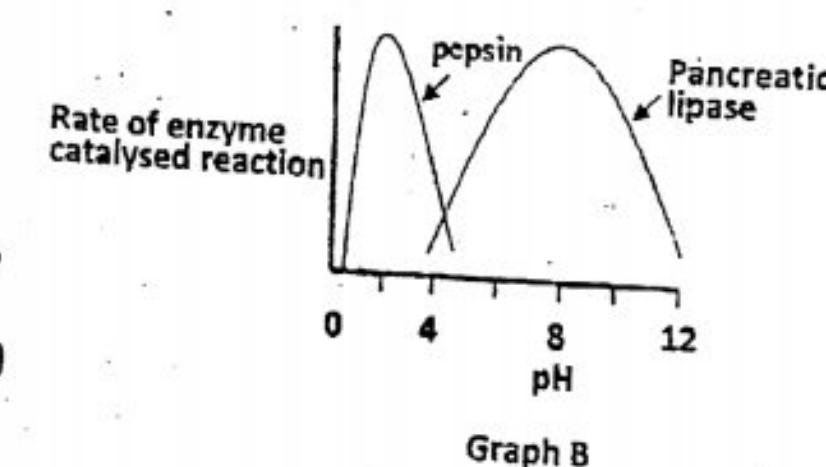
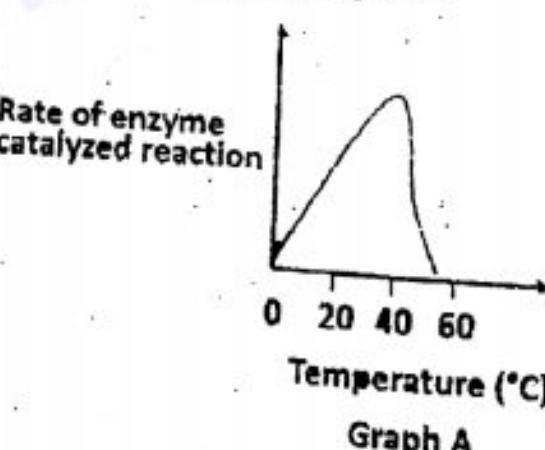
Ans: If the reaction temperature is changed from 25 C° to 35 C° , the rate of reaction will increase. But if the temperature of reaction is from 40 C° o to 60 C° , the reaction will stop.

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

Ans: The term used to describe the condition of the enzyme when it is heated to a temperature of 60 C° 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? When temperature increase above this point, what will happen to the enzyme?



Ans: According to graph A, the enzyme activity is maximum at 40 C° . 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 moves away 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.

ADDITIONAL MULTIPLE CHOICE QUESTIONS

- 1- The sum of chemical reactions take place in living bodies is called _____
 - a. Respiration
 - b. Photosynthesis
 - c. Metabolism
 - d. digestive enzymes
- 2- enzymes are
 - a. Protein
 - b. Fats
 - c. Carbohydrate
 - d. Fibers
- 3- Smaller molecules combine to form larger molecules in
 - a. Respiration
 - b. Anabolism
 - c. Catabolism
 - d. both B and C
- 4- large molecules are broken down into simpler in
 - a. Photosynthesis
 - b. anabolism
 - c. Catabolism
 - d. both A and B
- 5- The term "enzymes" was first time used by German physiologist
 - a. Robert Hook
 - b. Winhelm Kuhne
 - c. Robert brown
 - d. mendel
- 6- The enzymes which catalyse hydrolysis is
 - a. pepsin
 - b. lipase
 - c. amylase
 - d. Hydrolases
- 7- Which one of the following is the example of intracellular enzymes
 - a. Mitochondrial enzymes
 - b. enzymes of stomach
 - c. both A and b
 - d. none of these
- 8- Which one of the following is the example of extracellular enzymes.
 - a. Mitochondrial enzymes
 - b. enzymes of stomach
 - c. pepsin
 - d. Both B and C
- 9- Good source of manganese is
 - a. strawberries
 - b. blue berries
 - c. black berries
 - d. All of these
- 10- The enzymes which digest proteins is
 - a. amylase
 - b. Protease
 - c. lipase
 - d. ptyalin
- 11- The enzymes which digest cellulose is
 - a. amylase
 - b. protease
 - c. Cellulase
 - d. lipase
- 12- The enzymes which digest starch is
 - a. lipase
 - b. Amylase
 - c. cellulase
 - d. protease
- 13- The lock and key model was proposed by a German chemist in 1894.
 - a. Winhem kuhne
 - b. Emil fischer
 - c. Daniel koshland
 - d. Singer and Nicolson

- 14- According to lock and key model enzymes act as a
 - a. Lock
 - b. key
 - c. both A and B
 - d. none of these
- 15- According to lock and key model substrate acts as a
 - a. lock
 - b. Key
 - c. both A and B
 - d. none of these
- 16- In 1958 an American biologist Danial Koshland proposed A model called
 - a. Lock and key model
 - b. Induced fit model
 - c. Fluid mosaic model
 - d. both A and B
- 17- The average temperature of human body is
 - a. 37 C°
 - b. 38 C°
 - c. 39 C°
 - d. 40 C°
- 18- Human enzymes start to denature quickly at a temperature above
 - a. 30 C°
 - b. 40 C°
 - c. 50C°
 - d. 60C°
- 19- Pepsin work best at a pH
 - a. 2
 - b. 3
 - c. 4
 - d. 5
- 20- Trypsin works best at a pH
 - a. 2
 - b. 4
 - c. 8
 - d. 10
- 21- The body temperature at 104 C° is known as critical because it cause
 - a. nerves breakdown
 - b. boiling of body water
 - c. Enzymes stop to work
 - d. None of them

THE TERMS TO KNOW

Activation energy	Optimum pH	Intracellular enzyme
Active site	Inhibitor	Extracellular enzyme
Amylase	Lipase	Substrate
Cofactor	Hydrolysis	Product
Denaturation	Hydrolases	Co-enzyme

Chapter No.7 Bioenergetics

Q 1. 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 (conversions) 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 reactions.

- (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: Photosynthesis

ii. Exergonic reaction:

Definition:

The reactions that release energy are called exergonic 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

Q 2. What is oxidation Reduction reaction? Write its importance.

Ans: Redox reaction:

Definition:

A chemical reaction in which both oxidation and reduction occur is called Redox reaction.

Oxidation:

Definition:

Addition of oxygen or loss of hydrogen or electron is called oxidation.

Reduction:

Definition:

The gaining of electron or hydrogen is called reduction.

Oxidation-reduction reactions:

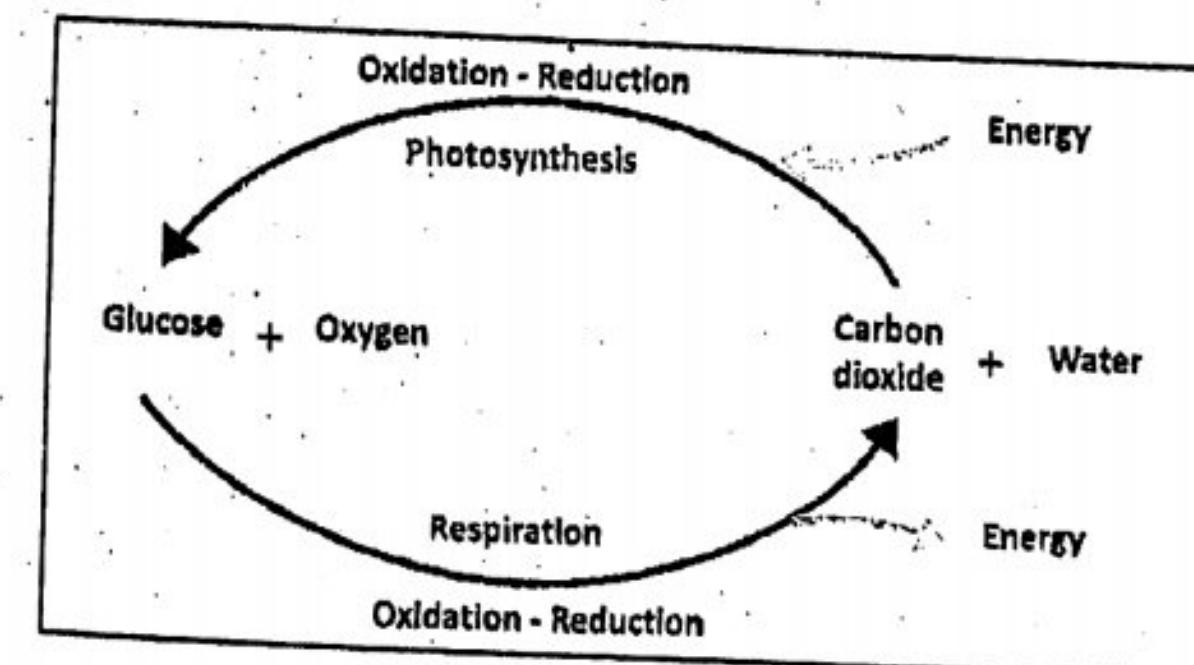
Those reactions in which oxidation and reduction occur simultaneously is called oxidation-reduction or redox reaction.

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.



Q 3. 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.

Three phosphate groups are bonded with adenosine to form ATP Molecule.

Bonds in ATP Molecules:

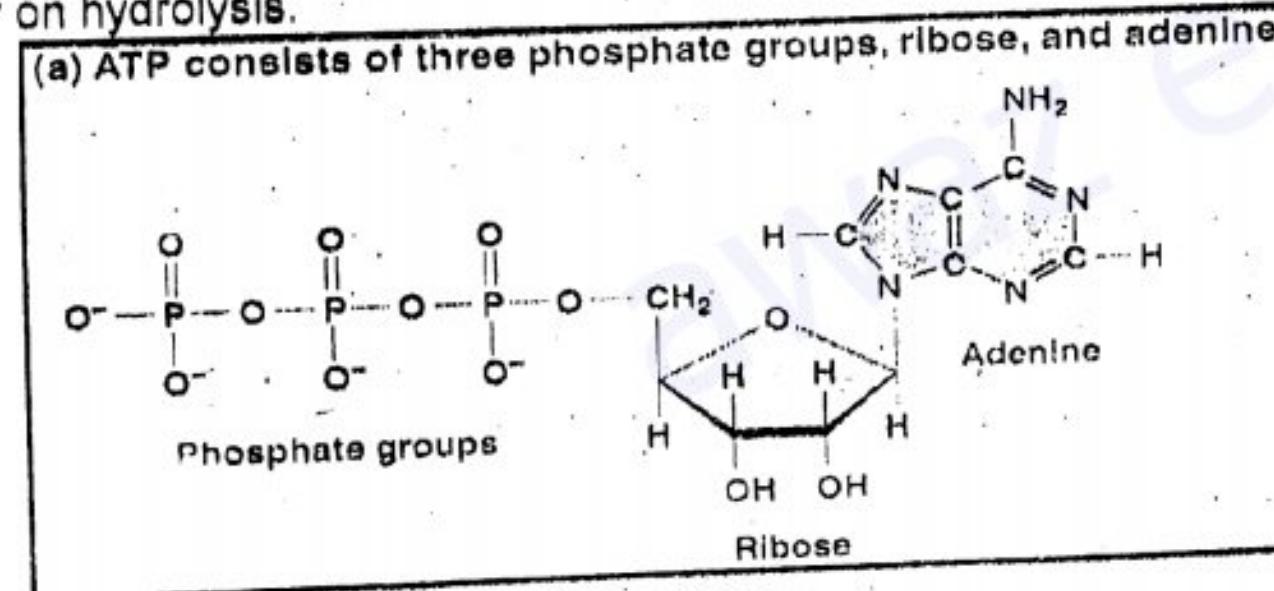
There are two types of phosphate bonds in ATP Molecules.

I. High energy bond:

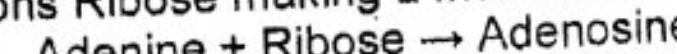
These bonds are represented by symbol (~) and these bonds yield more energy (7.3 K.calories) on hydrolysis.

II. Low energy phosphate bond:

These bonds are represented by straight line (---). And they yield less energy on hydrolysis.

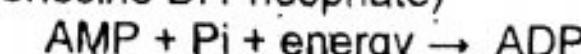
**Q 4. Write note on the synthesis, breaking and recycling of ATP?**

Ans: Adenine is a nitrogenous base when covalently bonded to five carbons Ribose making a Molecule Adenosine.

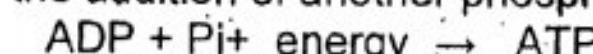
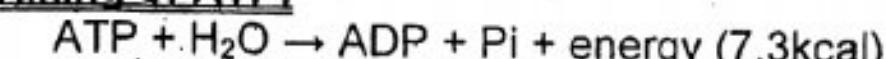


- (i) When Phosphate Molecule bonded with Adenosine forming a nucleotide called AMP (Adenosine mono Phosphate)

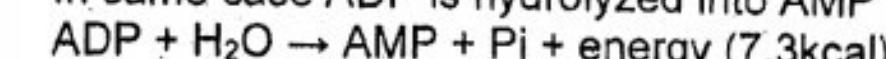
(ii) By addition of phosphate with AMP Molecules called ADP (Adenosine Di Phosphate)



(iii) By the addition of another phosphate with ADP form ATP.

**Breaking of ATP:**

In same case ADP is hydrolyzed into AMP

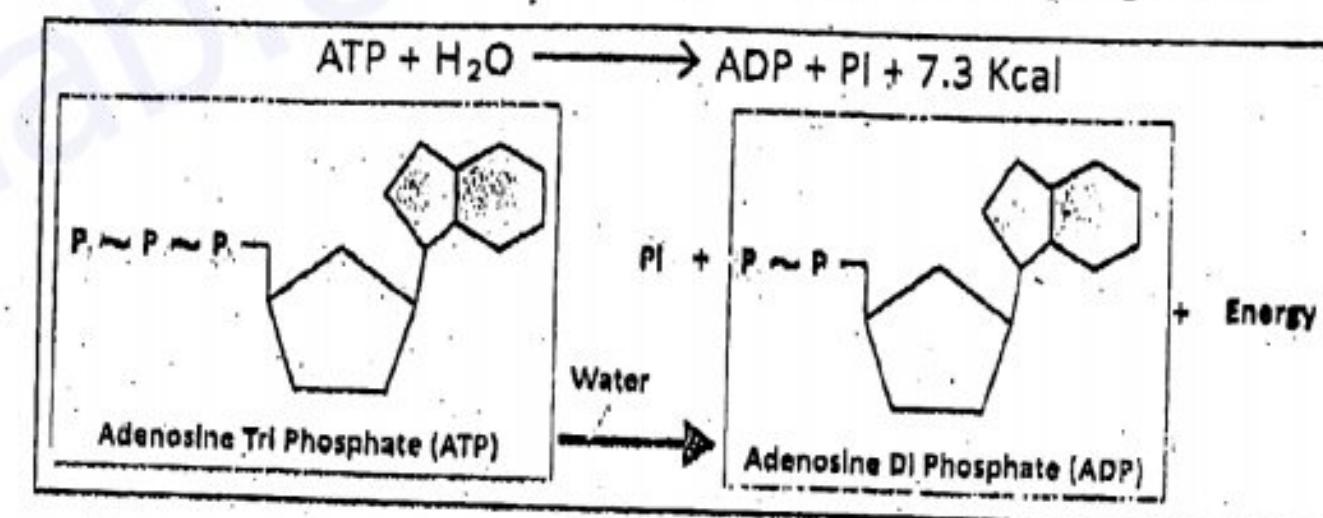


AMP cannot hydrolyze further.

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:**

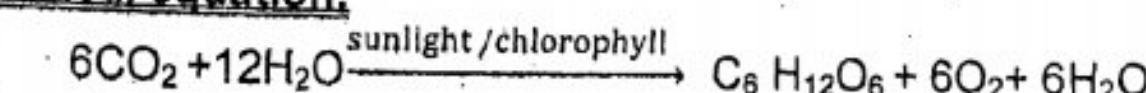
The word photosynthesis is derived from two Greek words.

(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:

Importance:

- 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 because it is a process in which food as well as oxygen is produced.

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 ($C_6H_{12}O_6$) 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 photosystem.

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 390-430nm 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 are seen just like a pile of coins which is composed of stack of thylakoids.

Thylakoid: (Gr: thylakos mean sac or pouch)**Function:**

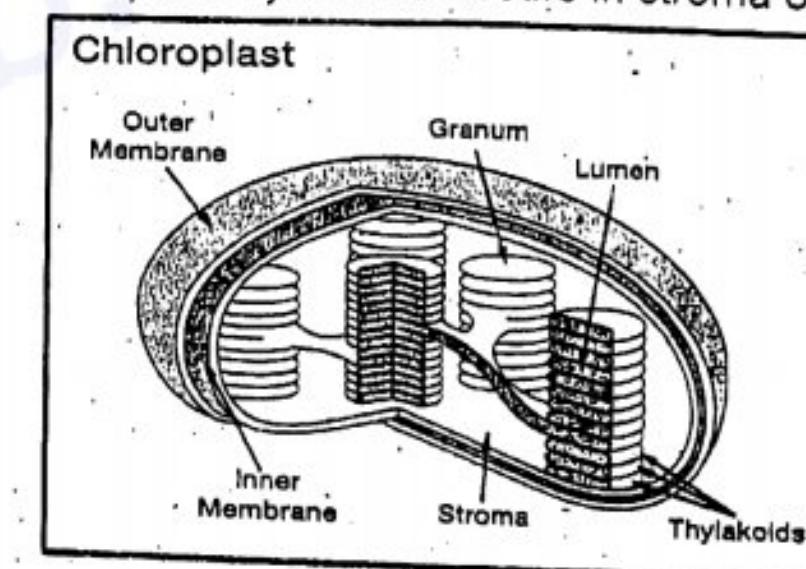
Light reaction of photosynthesis occurs in grana of chloroplast

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.

**Q 8. 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 material 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 diffuse

into the green cells and enters the stroma of chloroplasts. In the dark reaction of photosynthesis, CO_2 molecules are reduced to form glucose molecules.

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 the 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:

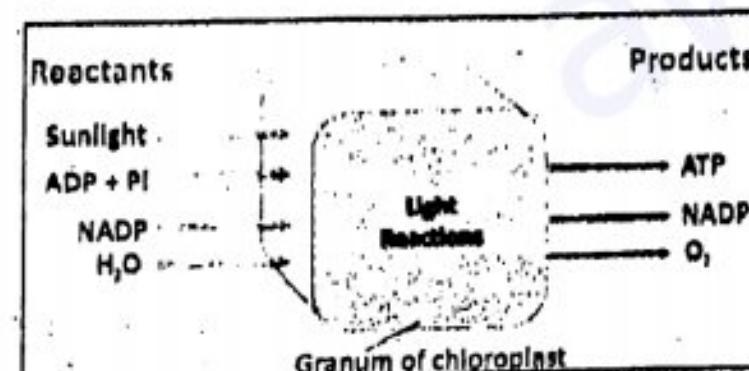
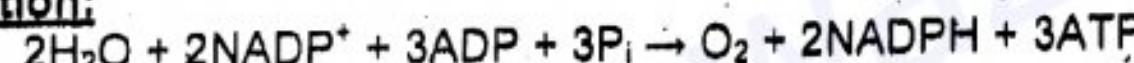
The Process of Photosynthesis is completed in two main steps.

- 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 takes 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 ATP and NADPH are produced. Which are used in dark reaction as energy source.

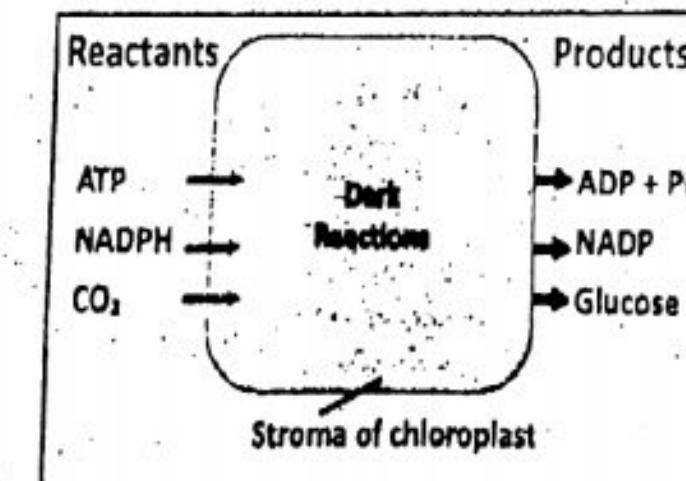
Equation:



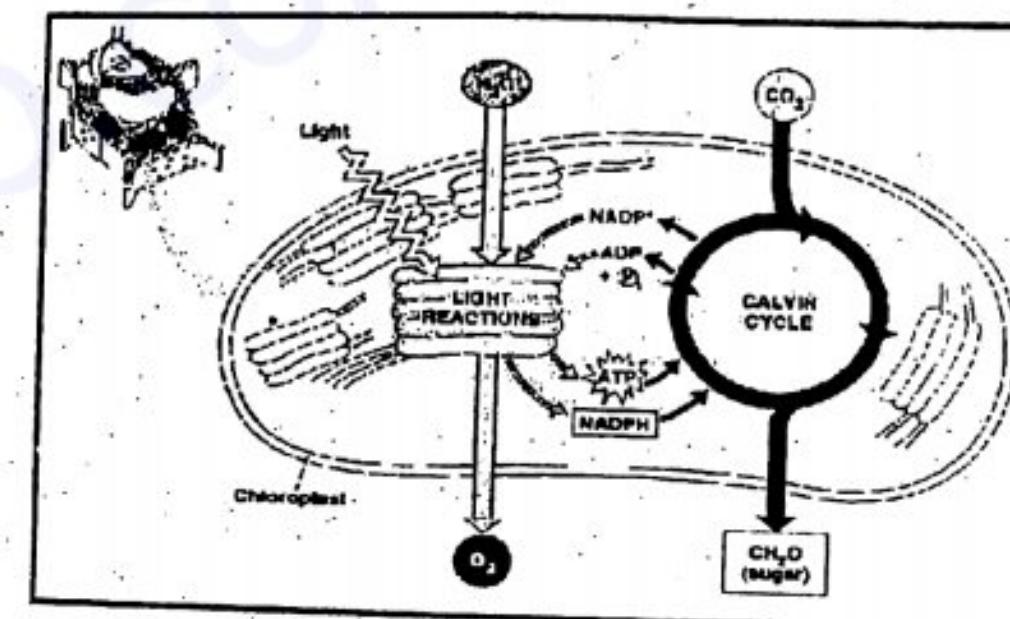
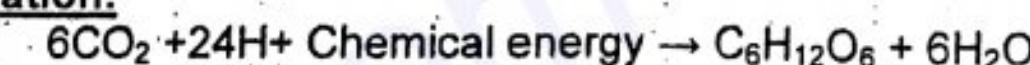
II. Dark reaction (Calvin cycle):

- 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:



Q10. 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. Statement:

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".

OR

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 light intensity:

The light provides energy for the reaction of CO_2 and H_2O during photosynthesis. Low intensity of light change the shape of chlorophyll molecule. Hence the rate of photosynthesis also low down.

ii. Effect of CO_2 Concentration:

CO_2 comes from the air there are 0.03% CO_2 in 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 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 20°C to 30°C is most suitable temperature. When temperature exceeds 30°C , the rate of photosynthesis lower down and below 20°C the rate of photosynthesis decreases while on freezing temperature photosynthesis completely stops and at 45°C the photosynthesis becomes stop.

Q 11: Define respiration and its types.

Ans: Respiration:

An oxidation reduction process by which organic food is broken down to carbon dioxide and water and releases 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 activities.

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. Krebs cycle

III. Electron transport Chain

Q 12 : Compare lactic acid fermentation with Alcoholic fermentation?

Ans: Lactic Acid Fermentation:-

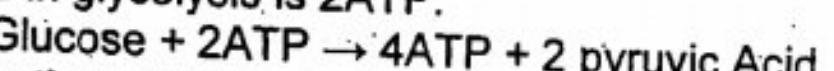
It is called lactic Acid fermentation because the end product is Lactic Acid. It occurs in microorganisms just like bacteria during the fermentation of milk. It also occurs in muscle cells when the energy demand is high.

Steps:

It is completed in two steps.

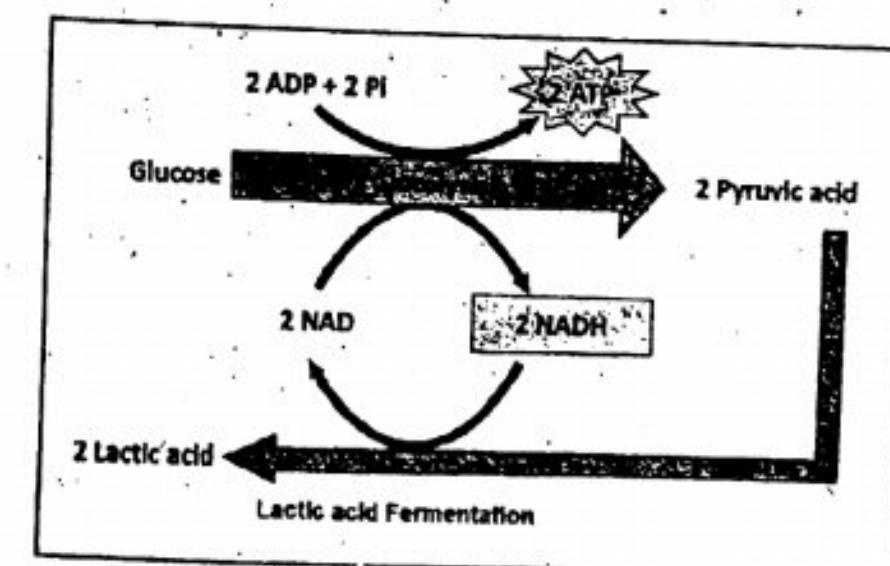
i. Glycolysis:

In this step glucose molecules are broken down into pyruvic acid by the use of 2ATP Molecules and produce 4ATP Molecules. So the net ATP produced in glycolysis is 2ATP.



ii. Reduction of Pyruvic Acid:

In the second step Pyruvic Acid is reduced by NADH+H (co-enzyme) and converted into lactic Acid.

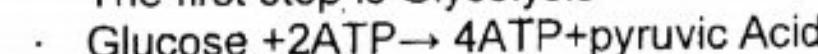


Alcoholic fermentation:

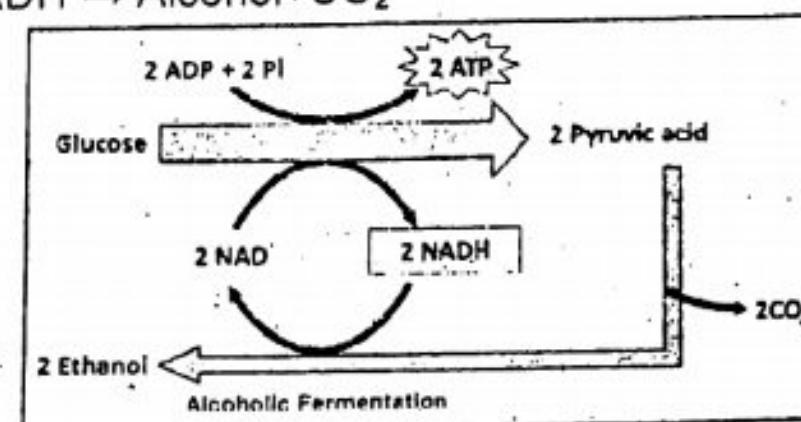
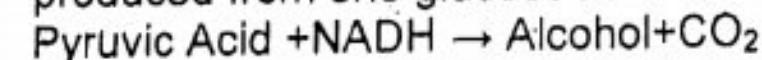
In alcoholic fermentation the end product is alcohol. It occurs in yeast and in some bacteria.

i. Glycolysis:

The first step is Glycolysis

**ii. Formation of Ethyl Alcohol:**

In the second step pyruvic Acid is reduced by $\text{NADH} + \text{H}^+$ to ethyl Alcohol (ethanol). In alcoholic fermentation also two ATP molecules are produced from one glucose molecule.

**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:

**Steps of aerobic respiration:**

Aerobic respiration completes in three steps.

- I. Glycolysis
- II. Krebs cycle
- III. Electron transport Chain

(I) Glycolysis:**Meaning:**

- > Glyc mean glucose,
- > sis. mean splitting

Definition:

The stepwise enzymatic break down of glucose upto 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 down into two molecule 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 Krebs cycle.

Location:

It occurs in mitochondria because inside space necessary enzymes are present for reaction.

Discovery:

This step was first discovered by sir Hans Krebs therefore named after his name Krebs cycle.

Explanation:

Before entering to Krebs 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 reaction produced CO_2 along with ATP, NAD and FAD. NAD and FAD are also reduced into NADH and FADH_2 respectively.

(III) Electron transport chain:**Definition:**

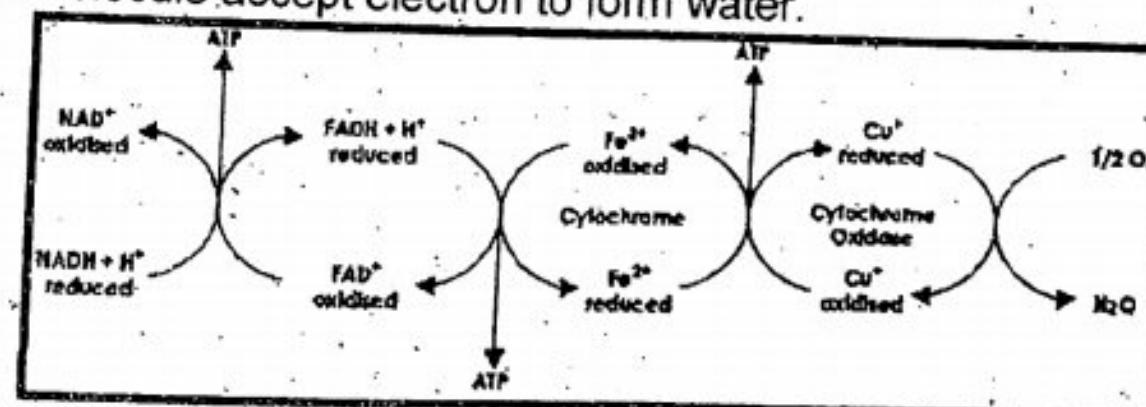
The final step of aerobic respiration in which the oxidation of reduced Coenzyme NADH and FADH_2 take place that produce in glycolysis and kreb cycle.

Location:

It is the last step of aerobic respiration that occurs in mitochondria.

Explanation:

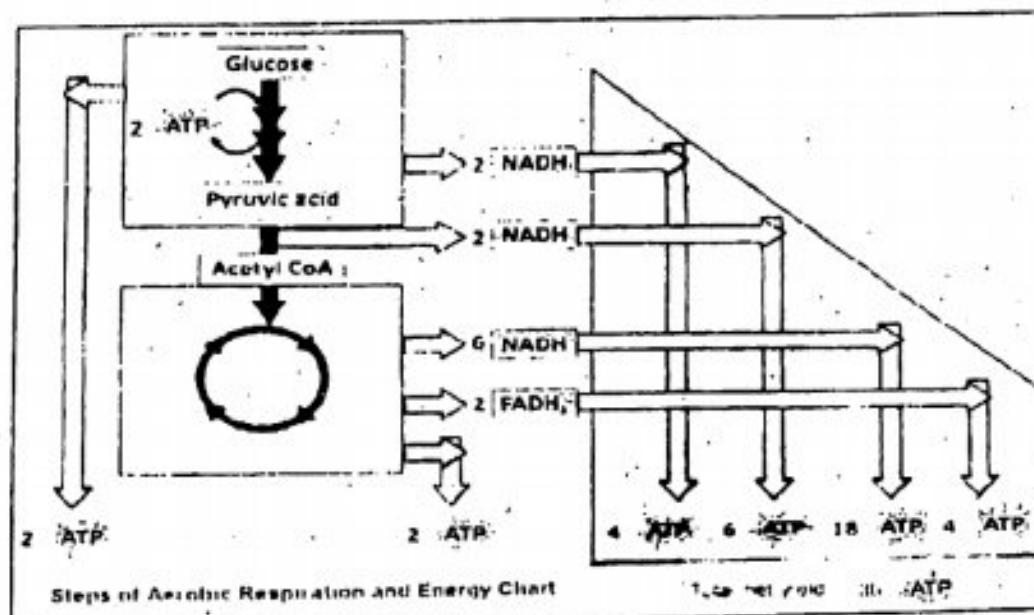
During this step two electrons are released from NADH and FADH_2 . These electrons are than pass a series of electron carrier called cytochrome. During the transport from one cytochrome to the other electron loss energy. This energy is used to form ATP from ADP and P_i . At the end, oxygen molecule accept electron to form water.



Q 14: How much energy is produced during respiration?

Ans: Energy is produced during aerobic respiration:

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. But the NADH produce during glycolysis give 2 ATP because one ATP is consumed during the transport of NADH to mitochondria.

**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 breakdown of food molecules occurs
Importance	Major source of energy for most organisms	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 day time only, in the presence of light	All the time
CO_2 and H_2O	CO_2 and H_2O are used as a raw materials	CO_2 and H_2O is produced as a waste products
Oxygen	Oxygen is produced as a by product	Oxygen is required for Aerobic Respiration

EXERCISE**MULTIPLE CHOICE QUESTIONS****A. Encircle the best suitable answers**

1. The site of the cells for the dark reaction is:
 - (a) Mitochondria
 - (b) Ribosome
 - (c) Granum of chloroplast
 - (d) Stroma of chloroplast
2. The organisms responsible for trapping light energy are:
 - (a) Plants
 - (b) Photosynthetic organisms
 - (c) Algae
 - (d) Fungi
3. Photosynthesis takes place in:
 - (a) Mesophyll cells
 - (b) guard
 - (c) phloem cells
 - (d) All of the above
4. One of the following is not a limiting factor for enzymes in photosynthesis:
 - (a) CO_2 concentration
 - (b) temperature
 - (c) light intensity
 - (d) Pigments

5. One of the following fair of light colours is important for photosynthesis:
 (a) Green and yellow (b) yellow and orange (c) green and orange (d) Red and blue
6. One of the following may not be required for respiration
 (a) Oxygen (b) food molecule (c) Enzymes (d) CO_2
7. In the structure of ATP, the three phosphate groups are linked to:
 (a) Ribose (b) Glucose (c) Adenine (d) H_2O
8. A car engine uses fuel for work to do. The carry out functions, a living cell uses:
 (a) Electric power (b) generator (c) ATP (d) heat energy
9. Inside a bacterial cell, glycolysis occurs in:
 (a) Mesosome (b) cytoplasm (c) mitochondria (d) nucleoid
10. The consumption during the conversion of pyruvic acid into ethanol during anaerobic respiration is /are
 (a) One NADH_2 (b) one NADH_2 and CO_2 (c) Two NADH_2 (d) CO_2

SHORT QUESTIONS

Q1: Why ATP is regarded as the currency of the living cells?

Ans: ATP as currency of energy:

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: Role of pigment during photosynthesis:

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 wavelength of blue light is 390-430 nm and the wavelength 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: Comparison of Lactic acid fermentation with alcoholic fermentation:

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 to form yeast.
4	It also occurs in human muscles.	It also occurs in plants.
5	$\text{C}_6\text{H}_{12}\text{O}_6 + 2\text{ATP} \rightarrow 2(\text{C}_3\text{H}_4\text{O}_3) + 4\text{ATP}$ $2(\text{C}_3\text{H}_4\text{O}_3) \rightarrow 2(\text{C}_2\text{H}_5\text{OH}) + 2\text{CO}_2$	$\text{C}_6\text{H}_{12}\text{O}_6 + 2\text{ATP} \rightarrow 2(\text{C}_3\text{H}_4\text{O}_3) + 4\text{ATP}$ $2(\text{C}_3\text{H}_4\text{O}_3) \rightarrow 2(\text{C}_2\text{H}_5\text{OH}) + 2\text{CO}_2$

Q5: Why are oxidation and reduction important for plants?

Ans: See Q No. 2

LONG QUESTIONS

C. Give detailed answer of the following questions.

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 than anaerobic respiration?

Ans: Aerobic respiration is considered to be more efficient than anaerobic 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 than 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 molecule.

Q 4: 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 produced. 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 from the Krebs cycle means that one molecule of glucose (sugar) can make a total of 36-38 ATP.

ADDITIONAL MULTIPLE CHOICE QUESTIONS

- 1) The study of transformation of energy in organism is called
a. digestion b. respiration c. Bioenergetics d. breathing
- 2) the ultimate source of energy is
a. meat b. rice c. fruits d. sun
- 3) The energy currency of cells is
a. ATP b. glucose c. proteins d. fats
- 4) ATP stand for
a. Adenosine monophosphate b. adenosine diphosphate
c. Adenosine triphosphate d. none of them
- 5) One bond between phosphate in ATP broken to release
a. 7100 calories b. 7200 calories c. 7300 calories d. 7400 calories

- 6) The word photosynthesis is the combination of two _____ words.
a. Greek b. Italian c. Roman d. Latin
- 7) Photosynthesis occur in
a. Plants b. algae c. cyanobacteria d. All of the above
- 8) CO_2 is diffused into the intercellular space of leaf through
a. roots b. root hairs c. stomata d. stem
- 9) Light reaction takes place in
a. Grana b. stroma c. centriole d. lysosomes
- 10) Dark reaction take place in
a. grana b. Stoma c. mitochondria d. lysosomes
- 11) Carbon dioxide is almost _____ % in air.
a. 0.01 b. 0.02 c. 0.03 d. 0.04
- 12) Glycolysis takes place in
a. Cytoplasm b. mitochondria c. Ribosome d. Nucleus
- 13) Krebs cycle takes place in
a. cytoplasm b. mitochondria c. ribosome d. nucleus
- 14) How many ATP molecules are produced in aerobic respiration
a. 34 b. 38 c. 40 d. 42
- 15) One NADH Produce
a. 3 ATP b. 4ATP c. 6 ATP d. 8 ATP
- 16) One FADH₂ produce
a. 2 ATP b. 3 ATP c. 4ATP d. 6ATP
- 17) Photosynthesis takes place in
a. Guard cells b. Phloem cells c. Mesophyll cells d. all of the above
- 18) In the structure of ATP the three phosphate groups are linked to
a. Adenine b. Ribose c. Glucose d. H_2O

THE TERMS TO KNOW

Acetyl- CoA	Lactic acid	Oxidation
Adenine	Alcohol	Photosystem
ADP	Photolysis	Starch
Fermentation	NADPH	Thylakoids
Bioenergetics	reduction	Coenzyme-A
Autotrophic	oxidation	Pigment
Ribose	FAD	Lactose

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.

Q 2. 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 small amount for body are known as micronutrients.

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.

Q 3. 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.

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
Micronutrients	Calcium	Activates enzymes, is a structural component of cell wall, Influences water movement in cells
	Magnesium	Component of chlorophyll, activates many enzymes
	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.

Note:

If any one of these is not supplied, plants display abnormalities of growth and do not reproduce normally.

Q 4. 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 nut 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).

Q.5. 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 color and more attractive 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 ($NaNO_3$) etc.
- They dissolve readily in water and immediately available to plants for uptake.
- Examples are sodium nitrate, milled rock, phosphate and limestone.

Advantages of inorganic fertilizers:

- It promotes protein synthesis.
- It also increase chlorophyll synthesis
- It Increase the growth of stem and leaves
- High amount of phosphorus result in healthier roots and more flowers.

Q 6. Enlist environmental hazards related to use of chemical fertilizers.
Ans : Environmental hazards:

Environmental hazards related to use of fertilizers are;

- i. Increasing the salinity and acidity of soil
- ii. The massive quantities of inorganic 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.
- iv. Its high solubility also causes eutrophication (increase algal growth on the surface of water) and cause the death of aquatic organisms like fish etc.
- v. Bad smell from manure affects air quality.
- vi. Increase the pathogens which cause diseases in human and animals

Q 7. 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 poly 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 carbohydrates are commonly called hydrated carbon.

Sources:

Major sources of carbohydrates are rice, sugar, honey, potato, bread and cereal etc.

General formula:

General formula is $(\text{CH}_2\text{O})_n$ where "n" stand for number.

Classification:

- i. Monosaccharides 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. Structure Component:

In plants cell wall is composed of cellulose which is a polysaccharide.

III. Storage molecule:

Excess of glucose in plant is converted into starch. While in animals surplus glucose is stored in liver in the form of glycogen.

Q 8. Write note on protein?

Ans: Protein

Meaning:

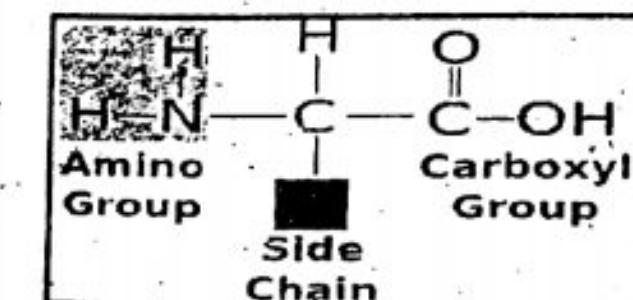
The word protein is derived from Greek word protius means "substance of first importance".

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.
- -NH₂ 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' sources:** milk, poultry, fish, meat.

Shape:

Proteins may be fibrous e.g. keratin in hairs or may be globular e.g. hemoglobin.

Importance of Proteins:

i. Source of energy:

Protein acts as a source of energy. One gram of protein provide 1 kilo calories of energy.

ii. Structural component:

Protein makes body parts such as muscles, tendons, hairs, nails, hoof etc. It is also essential component of cell membrane, cytoplasm and organelles.

iii. Source of chemical components:

Source of antibiotics, enzymes, hormone

Q 9. 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 sources 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 vitamin 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 because they cannot stay as much in our body.

ii. Fats soluble vitamins:

Vitamins A,D,E,K are fats soluble vitamins because fats soluble vitamins stay for a few days while some for six months and can use them when needed.

Q 11. Write the sources, importance and deficiency symptoms of vitamin A, C and vitamin D?**Vitamin "A":**

It is fat soluble vitamin.

Chemical name:

The chemical name is retinol because it help in the functions of the retina of eye.

Sources:

Animal sources: Chicken liver, code liver 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 diseases will be increases. e.g measles and chickenpox etc.

Vitamin "C":

It is water soluble vitamin,

Chemical name: It is also called Ascorbic Acid

Sources:

Orange, lemon, grapes, 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 ,
- vii. 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 synthesized by skin when UV radiations from sun are used to convert cholesterol derivatives into vitamin D.

Metabolic Role:

- i. Vitamin "D" helps in the absorption of calcium and phosphorous.
- ii. Vitamin "D" help to regulate blood level of calcium and phosphorus.
- iii. It help in the normal function of muscles and nerves.
- iv. It keep 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 becomes 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:

Minerals 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, phosphorus and sulphur.

ii. Trace minerals:

Those minerals that require in amounts less than 100 mg per day. e.g. Fe, zinc, Cu, Cr, F, 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 phosphorus help in the development and maintenance of bones and teeth.
- Iodine essential for normal thyroid function.
- Iron is the central component of hemoglobin that transport oxygen in blood.

Q 13: Write the sources Role and deficiency symptoms of calcium.**Ans: Calcium:**

It is one of the most important and abundant mineral 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.

Sources:

Dairy products like milk and cheese are the major source of calcium. Other sources are 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 become soft.
- v. Blood clotting become slow.
- vi. Wounds heal slowly.

Q 14 : Write the sources, Role and Deficiency symptoms of iron?**Iron:**

It is also an important major type of mineral.

Sources:

Red meat, fish, beans, dried fruit, green vegetable and apple.

Metabolic Role of Iron:

- i. Iron helps in transportation and storing of oxygen.

- ii. It is the component of hemoglobin in red blood cells and myoglobin in muscle cells.
- iii. Cellular energy also requires iron which act as enzyme cofactor.
- iv. It also supports immune system.

Deficiency symptoms:

- i. Its deficiency cause anemia (decrease in the amount of RBCs or hemoglobin in the blood).
- ii. The patient feels fatigue, weakness and rapid heartbeat.

Q 15: What are dietary fibers? 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 don't dissolve in water and travels through small intestine quickly.

Source: Wheatbran, 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 or piles).
- 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 (cancer causing agents).
- 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?

Water is the most abundant substance in human body. Our body contains 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 substance 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 regulates body temperature. It absorb 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 other lubricating fluids.

Q 17. 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 need 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 requirements 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 (80kg) 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

Q 18. Define malnutrition. Discuss the types of malnutrition?**Ans: Malnutrition:**

A diet which is missing in one or more essential nutrient cause malnutrition. OR

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

- Protein energy malnutrition (PEM)
- Mineral deficiency disease (MDD)
- Over intake of nutrients (OIN)

i. 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 of 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 color and do not break.	Skin change color 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.



Marasmus
It is an extremely severe type of malnutrition disorder in which there is significant wasting of fat, muscle and tissue of the body.
Some of the Risk Factors for Marasmus are-
1) Chronic starvation
2) Adulterated water
3) Inadequate food intake
4) Vitamin deficiencies.



(2). Mineral Deficiency diseases (MDD):

When the concentration of minerals are less than normal amount. It causes mineral deficiency diseases. Minerals deficiencies lead to variety of diseases such as,

- i. Anemia
- ii. Osteoporosis
- iii. 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 B₁₂.

ii. Osteoporosis:**meaning:**

- Osteo mean 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 (high blood pressure), liver, kidney and heart disorder.

ii. Hyper vitaminous "D":

- It cause due to over intake of Vitamin "D".
- Over intake of Vitamin "D" also causes nausea, fatigue, vomiting and renal disorder etc.

iii. Hypervitaminous "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.

Q 19: 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)

Q 20: Define digestion, ingestion, absorption, assimilation, egestion?

Ans: Digestion:

The breakdown of large, complex, non-diffusible and insoluble food into small, simple, diffusible and soluble form by the action of enzymes 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.

Q 21: 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. Oesophagus
- 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 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.

b. 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 helps us to sense the taste of food.

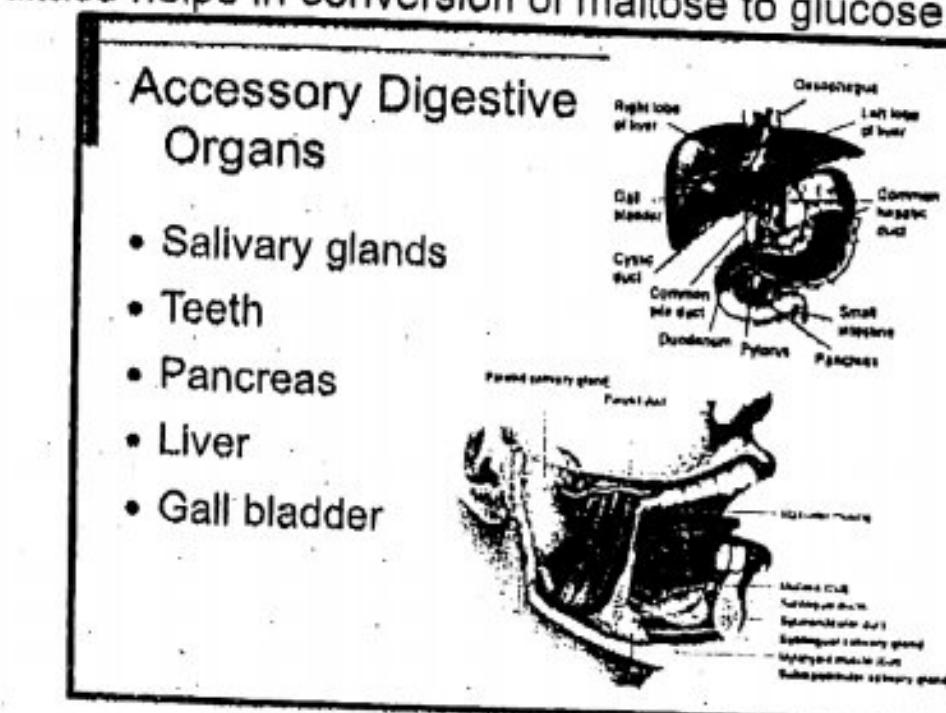
C. Salivary gland:

The glands present in oral cavity which secrete saliva are called salivary glands. There are three pair of salivary glands in oral cavity.

Saliva:**Composition:**

It contains mixture 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 help in digestion of starch and glycogen.
- Maltase helps in conversion of maltose to glucose.

**ii) Pharynx:**

The oral cavity opens 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: Osophagus is about 10 inch long tube.

Location: it runs through the neck and 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 oesophagus and intestine.

Size:

It is about 12 inches long and 6 inch wide at the widest point.

Capacity:

The capacity of stomach is 1liters.

Sphincter:

It the opening of stomach guarded by muscles called sphincters. Stomach has two sphincters.

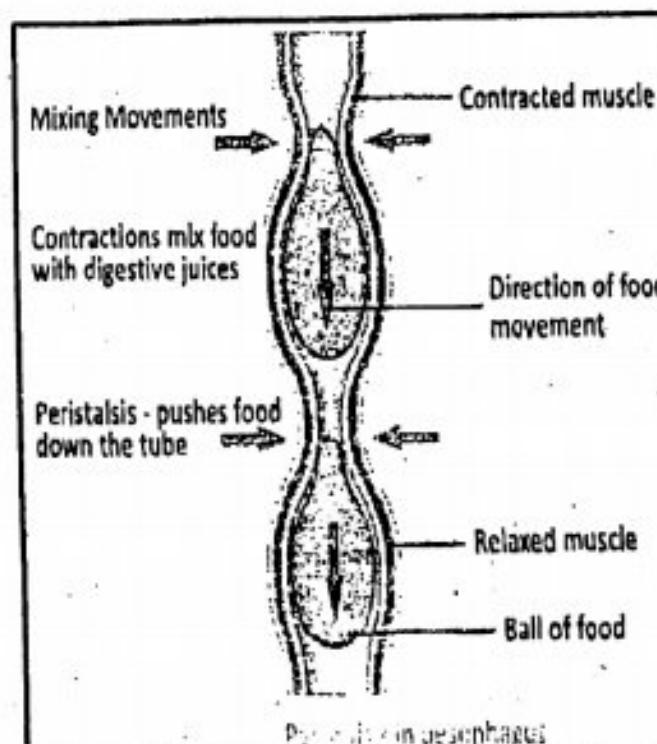
a) Pyloric Sphincter:

At the end of stomach pyloric sphincter is present which connect stomach with small intestine

b) Cardiac sphincter:

It is present between oesophagus and stomach.

Function of sphincter: Sphincter prevents the back movement of food.



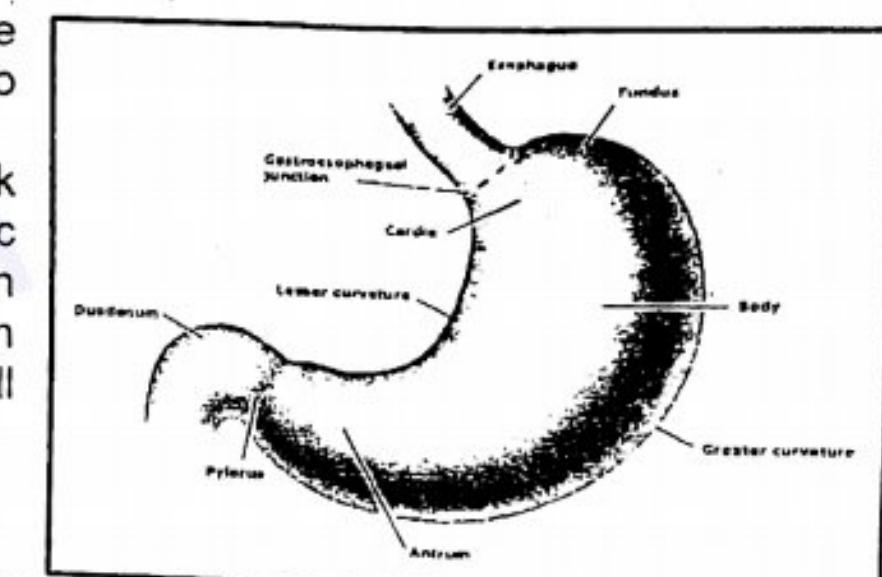
Gastric gland:

The inner wall of the stomach has 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 of 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 known 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:

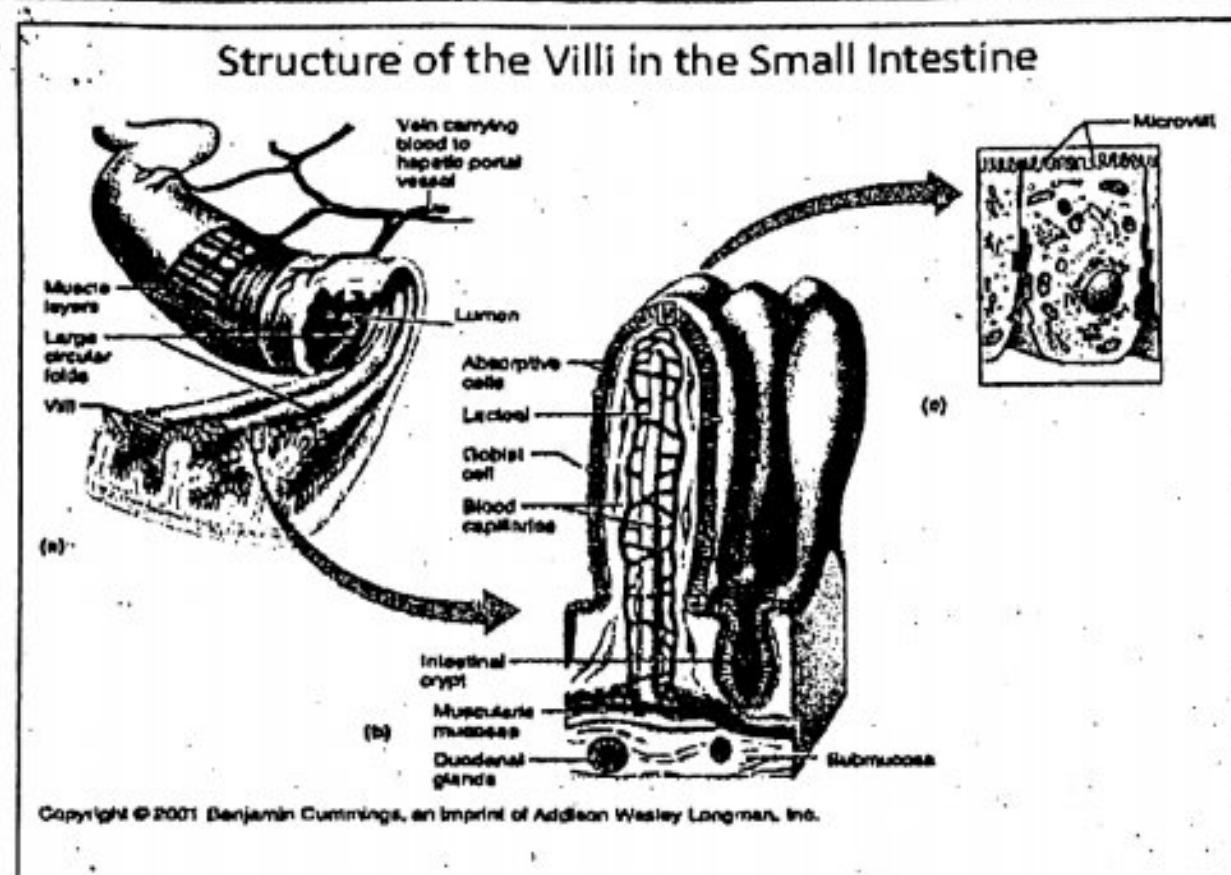
Stomach opens into small intestine.

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 inch long and curved like 'C'.
- It receives chyme from the stomach.
- In duodenum, the chyme receives the bile from the liver and pancreatic juice from the pancreas.



Two important associated glands open to duodenum are,

- Liver
- 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 1.5 kg.

Position: It lies beneath the diaphragm on the right side of the abdomen.

Lobes: It consists 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 stores and concentrates the bile.

Secretion of liver:

Liver secretes 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 of fats.
- It converts ammonia to a less toxic form urea.
- Formation of red blood cells in fetus in embryonic stages.
- Converts 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 and act as thermoregulator.
- 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 and 1.5 inch wide.

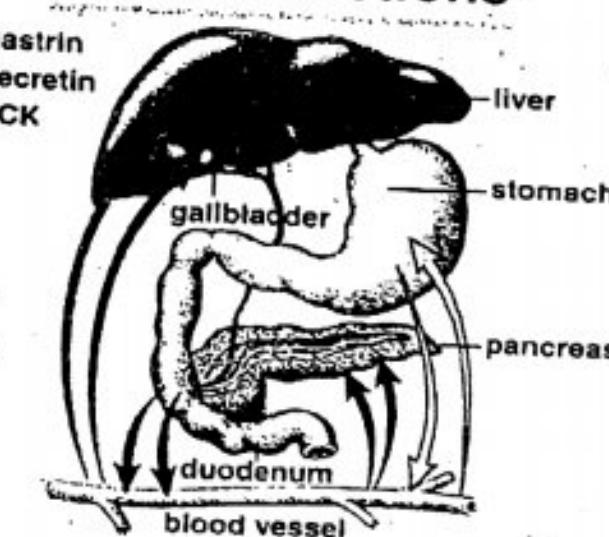
Secretion: Pancreas secretes pancreatic juice. Pancreatic juice contains sodium bicarbonate and enzymes. Sodium bicarbonate neutralizes the acidity of chyme while enzymes consist of three types. These enzymes are

- Trypsinogen
- Pancreatic Amylase
- Lipase

a) Trypsinogen:

It is inactive form of enzyme. It is converted to active form by the action of enterokinase (duodenal enzyme). The Active form is called trypsin. Trypsin helps in digestion of proteins.

Hormonal control of digestive gland secretions



b) Pancreatic Amylase:

The pancreatic Amylase converts starch into simple form called maltose.

C.Lipase: Lipase converts 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 2.4 m long.

III. Ileum :

It is the last part of small intestine and about 2.6 m long. The gland of ileum secretes intestinal Juice which contains many enzymes such as erepsin, Maltase, sucrose and lactase.

- Erepsin:** It converts protein into amino acids.
- Maltase:** It converts maltose into glucose.
- Sucrase:** It converts sucrose into glucose and fructose.
- Lactase:** It converts lactose into glucose and galactose.

Absorption of food:

After the complete digestion of food, aminoacid, 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 finger-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, aminoacids, 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 is about 1.5 m 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,

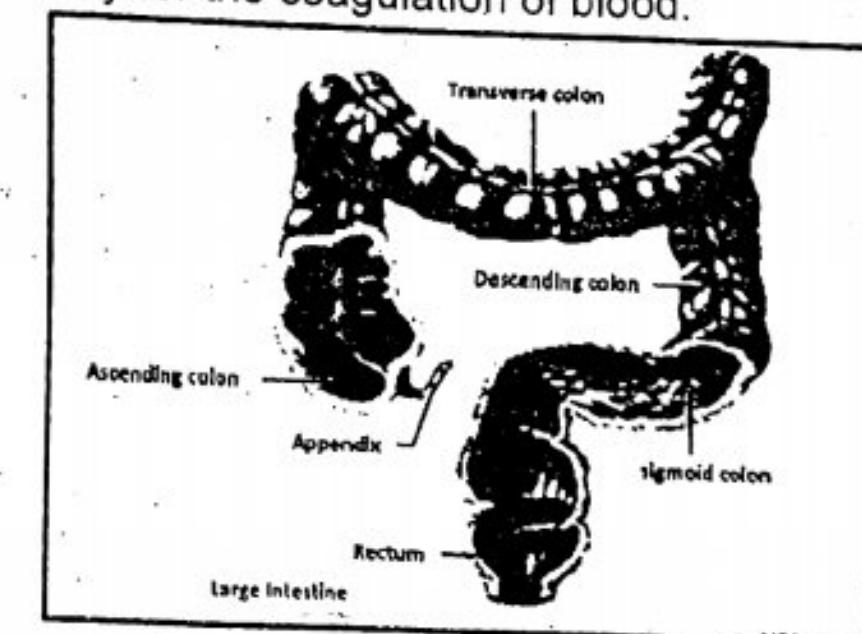
- Ascending colon:** Starts at the caecum at the bottom right hand side of the abdomen and ascends towards the liver.
- Transverse colon:** transverse mean across, this part of the colon extends across the abdomen from right to left.
- Descending colon:** this colon goes down ward on the left hand side of the abdomen.
- 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 feces from the body called egestion.

Function of large intestine:

- Reabsorbs water and maintains the fluid balance of the body
- Absorb certain vitamins.
- Processes undigested materials (fiber)
- Store wasted products before it is eliminated.
- Many bacteria live in colon. They produce vitamin "K" which is necessary for the coagulation of blood.



Q 22: 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 conditions in which the feces become dry, hard and not eliminating from the body at regular interval is known as constipation.

Symptoms:

- Passing hard or dry stools three times a week or less than three time a week.
- Unusual colour 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 fibre.
- Excessive use of food stuff that tends to create dryness of mucus membrane.

Treatment:

- Constipation is treated by taking more dietary fibre 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 a condition in which the patient suffers from frequent watery stool.

Symptoms:

- Diarrhea cause dehydration and loss of minerals which lead to kidney failure.
- It cause 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.

Cause:

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 feaces.
- 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.

EXERCISE**MULTIPLE CHOICE QUESTIONS****A. Encircle the best suitable answers**

1. The deficiency of which macronutrients causes chlorosis in plants
(a) carbon (b) oxygen (c) Nitrogen (d) calcium
2. All of the following are elements that plants need in very small amounts (micronutrients) except:
(a) Hydrogen (b) iron (c) chlorine (d) copper
3. Which substance, is used by plants to make proteins?
(a) carbon dioxide (b) oxygen (c) Nitrates (d) vitamins
4. What happens when food reaches the stomach?
(a) No digestion occurs in the stomach
(b) The food moves quickly in to the small intestine
(c) Juices mix with the food and stomach muscles squeeze it
(d) The food is completely digested and is absorbed into the circulatory system
5. Which of the following does not manufacture digestive juices?
(a) oesophagus (b) stomach (c) pancreas (d) intestine
6. What is absorbed from the material when it is in the large juice?
(a) Water (b) vitamins (c) salts (d) All of these
7. Which of the following is not a function of salivary glands?
(a) Start digestion of proteins (b) Helps in the lubrication
(c) secrete saliva (d) makes taste possible
8. The cardiac sphincter serves as a valve between:
(a) Stomach and duodenum (b) esophagus and stomach
(c) Duodenum and ileum (d) jejunum and caecum
9. The function of the liver is to
(a) Metabolize carbohydrates, lipids and proteins
(b) Break mature red blood cells
(c) Detoxify the chemicals
(d) All of the above
10. The digestive enzyme pepsin secreted by gastric glands begins the digestion of:
(a) Carbohydrates (b) proteins (c) fats (d) vitamins

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. Largeintestine,rectum,anus.

Q 2: How is food mechanically broken down during digestion?

Ans: Mechanical Digestion:

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 from 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 of villi and join the blood stream of hepatic portal vein.

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:

- 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).

Q 4: Enlist five environmental hazards related to the use of fertilizer?

Ans: See Q No.6

Q 5: What is malnutrition? Why it is considered to be a health hazard?**Ans: Malnutrition:**

Lack of proper nutrition is called malnutrition.

Causes:

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:

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.

Q 6 : Discuss the role of dietary fibers in balanced diets?**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.

Role of Dietary fibers:

- i. It prevents and relieves constipation and reduces the risk of pile.
- ii. It control weight by creating feeling of fullness.
- iii. It takes some acid away in the stool
- iv. It lower the cholesterol level in blood.
- v. It also lower the sugar level in blood.

LONG QUESTIONS

C. Give detailed answers to the following questions.

Q 1: Overtake of nutrition can lead to serious health disorders. Evaluate the statement by given example?

Ans: See Q NO.18

Q 2: List down major enzymes in human digestive system. Elaborate their role in digestion?

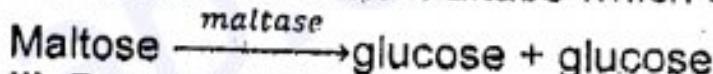
Ans: The enzymes which help in the digestion of food are called digestive enzymes. Some of the enzymes in human digestive system are;

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.

**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 converts starch into maltose.

v. Trypsinogen:

Pancreas also secretes 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 converts peptide into amino acid.

- **Maltase:** maltase convert maltose into glucose

- **Sucrase:** Convert sucrose into glucose and fructose

- **Lactase:** Convert lactose into glucose and galactose

Q 3: Explain the importance of water in the human body.
Ans: See Q NO.16

Q 4: Explain the role of oral cavity and pharynx in the digestive system.

Ans: See Q NO.21

Q 5: Describe the structure of a villus, including the roles of capillaries and lacteals?

Ans: See Q NO.21

ADDITIONAL MULTIPLE CHOICE QUESTIONS

1. Carbohydrates is made of
 - a) Carbon
 - b) hydrogen
 - c) oxygen
 - d) All of them
2. The sugar which we put in our tea and coffee is
 - a) Sucrose
 - b) Glucose
 - c) fructose
 - d) lactose
3. Which one of the following convert ammonia into urea.
 - a) Kidneys
 - b) stomach
 - c) Liver
 - d) heart
4. Which one removes urea from the body.
 - a) Kidney
 - b) stomach
 - c) liver
 - d) heart
5. One gram of carbohydrate fully oxidized to produce _____ energy.
 - a) 3 kilocalories
 - b) 4 kilocalories
 - c) 5 kilocalories
 - d) 6 kilocalories
6. One gram of fats produces energy.
 - a) 7 kilocalories
 - b) 8 kilocalories
 - c) 9 kilocalories
 - d) 10 kilocalories
7. Chemical name of vitamin "A" is
 - a) Retinol
 - b) ascorbic acid
 - c) calciferol
 - d) none of them
8. The deficiency of _____ vitamin causes night blindness.
 - a) vit.A
 - b) vit. K
 - c) vit.C
 - d) vit.D
9. Which one is essential in healing wounds.
 - a) vit.A
 - b) vit.C
 - c) vit.K
 - d) vit.D
10. Vitamin _____ deficiency is known as scurvy.
 - a) vit.A
 - b) vit.K
 - c) vit. C
 - d) Vit.D
11. Antioxidant is
 - a) vit.C
 - b) vit.E
 - c) vit. A
 - d) both A and B
12. An average adult requires about _____ litres water per day.
 - a) Three
 - b) four
 - c) Two
 - d) five
13. Thyroid gland enlarge in
 - a) Anemia
 - b) Goiter
 - c) osteoporosis
 - d) rickets
14. Sun is the source of
 - a) vit.C
 - b) vit.E
 - c) vit.A
 - d) vit. D

15. A disease in which bones become porous and fragile

- a) anemia
- b) goiter
- c) Osteoporosis
- d) rickets

16. There are _____ pairs of salivary glands.

- a) three
- b) four
- c) five
- d) six

17. The sphincter which separates stomach from duodenum.

- a) Pyloric sphincter
- b) cardiac sphincter
- c) both A & B
- d) none

18. Stomach is about _____ inches long

- a) 10
- b) 12
- c) 14
- d) 16

19. The appendix is a small projection emerging from

- a) Stomach
- b) colon
- c) caecum
- d) rectum

20. The deficiency of which cause chlorosis

- a) Carbon
- b) oxygen
- c) nitrogen
- d) magnesium

21. Bacteria are present in the

- a) Stomach
- b) duodenum
- c) caecum
- d) colon

22. In colon bacterial form

- a) vit.A
- b) vit.C
- c) vit.E
- d) vit. K

23. The final part of the large intestine is

- a) Colon
- b) rectum
- c) caecum
- d) none of them

24. Last part of small intestine is

- a) Ileum
- b) duodenum
- c) jejunum
- d) none of them

25. Lipids are soluble in

- a) Water
- b) organic solvents
- c) both
- d) none of them

26. The longest part of small intestine is

- a) Jejunum
- b) ileum
- c) duodenum
- d) Both A& C

27. The longest part of large intestine is

- a) caecum
- b) appendix
- c) colon
- d) rectum

28. When the faces are not eliminated from the body at regular interval the disease is called

- a) Constipation
- b) ulcer
- c) diarrhea
- d) cholera

THE TERMS TO KNOW

Malnutrition	Necrosis	Vitamin
Balanced diet	Eutrophication	PEM
Peristalsis	Insulation	MDD
Hepatic portal vein	Sucrose	OIN
chlorosis	Fructose	Goiter

Chapter No.9

Transport

Q 1. What is transport?

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 its 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:

a) In animals:

Transport in animals take place by blood circulatory system.

Blood circulatory system:

In animals food and oxygen is provided to all part of body with help of blood circulatory system.

b) In plants:

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 produces during its metabolic activities.

Q2. Describe transport in plants?

Ans :Transport:

Definition:

The movement of substances 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 grow in the soil and can transport many substances that needed for their growth like water and minerals for metabolism, CO₂ for photosynthesis, O₂ 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 by root hairs 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:

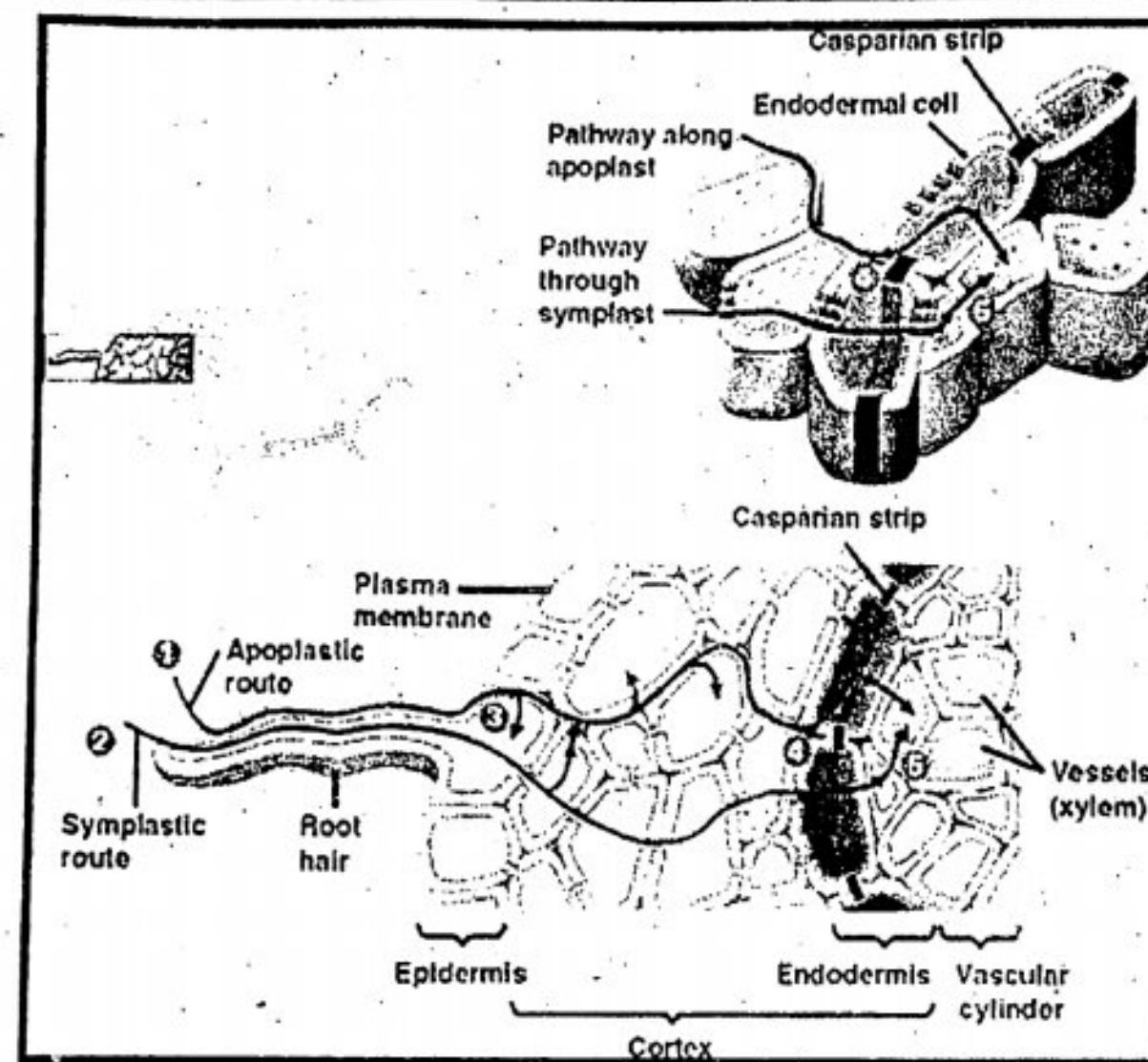
The innermost boundary of the cortex is the endodermis. From cortex water move to endoderm

e. Pericycle:

From endodermis 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.



Q 3: What is transpiration? Discuss transpiration from leaves?

Ans: Transpiration:

Definition:

The loss of water in the form of water vapors 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 stem of woody plants.

Transpiration occurs mainly 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.

Q 4: Discuss the stomatal control of transpiration?

Ans: Transpiration:

Definition:

The loss of water in the form of water vapors from 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 stomata are attached to each other at their ends. Guard cells are the only epidermal cell which contains chloroplasts.

Opening of stomata:

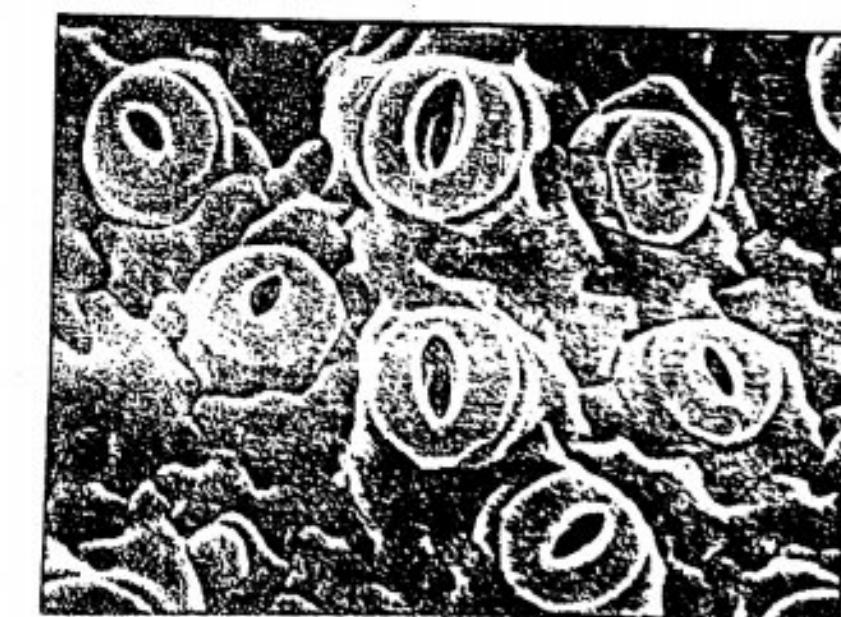
During day time, guard cells do photosynthesis and prepare glucose. So the solute concentration remains high in guard cells. Therefore water move in them and they become turgid and stomata become open.

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 starts closing and decrease in the rate of transpiration occurs.



Q 5. Write 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 increase with the increase in temperature. The rate of transpiration becomes double for every 10°C rise in temperature upto 30°C . Above 30°C the stomata start closing and at 45°C the stomata completely closed and the transpiration becomes stopped.

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.

Q 6: Write the significance of transpiration?**Ans:** Significance of transpiration:

- Transpiration is a vital process in the life of plants.
- Due to transpiration, the mesophyll cells always remain moist. This helps in gaseous exchange.
- Transpiration prevents the leaves from overheating and keeps them cool.

- It helps in the absorption of water from roots.
- It helps in the upward movement of water.
- It eliminates the extra water.
- It produce water column from roots to leaves by transpiration pull.
- It keeps balance the water level in plants.

Q 7. Transpiration is a necessary evil-discuss?**Ans:** Transpiration is a necessary evil:

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.

- Loss of water from plants causes wilting in hot summer season and sometimes even plants die.
- The shortage of water reduces the growth and the yield of crops like rice maize, wheat. Therefore it affects the economy of nation.
- 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.
- Deep tube wells are used for irrigation purposes it costs too much. This is also an economic loss.

Q 8: 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 materials) 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 water molecule.
- Narrow diameter of xylem vessels

- The forces by which water molecules are adhere to the wall of the xylem vessels.

Q 9: What do you know about the translocation of organic solutes in plants? OR How does the pressure flow theory explain the movement of sugars through phloem vessels of a plant?

Ans: When the food are 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" or 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:

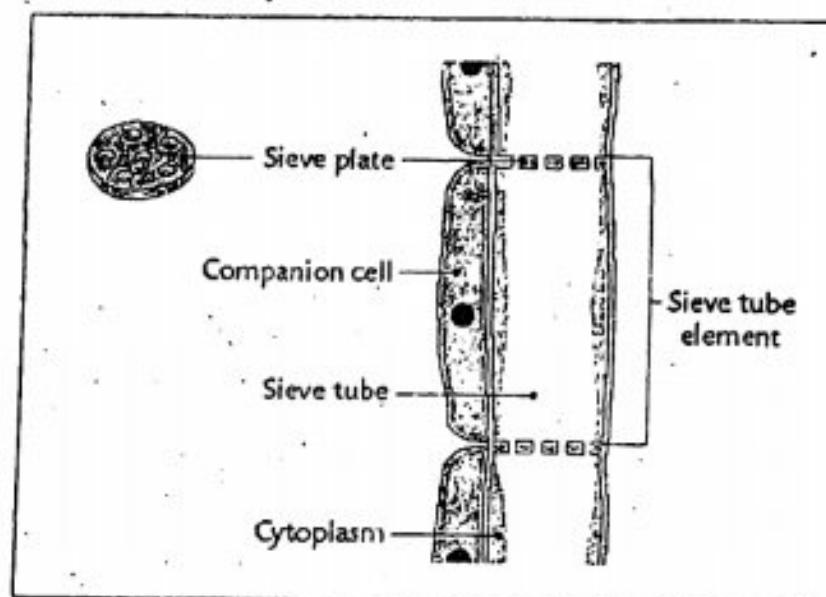
This theory was proposed by a German biologist Ernst Munch in 1930.

Statement:

According to this theory, the movement of dissolved food molecules occurs from source to sink.

Steps of translocation:

- 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.
- High solute concentration in sieve tubes absorbs water from nearby xylem tissue osmosis.
- Due to the movement of water, the turgor pressure in sieve tube increases and the solution of food starts flowing toward the sink.
- At the sink, food is actively removed from sieve tubes.
- 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.



Q 10: 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 $1/12^{\text{th}}$ of our body.
- The average adult has 5 liters of 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 of blood plasma:

- Plasma keeps all the tissues moist.
- Plasma of the blood transports nutrients, water, salts, hormones and waste materials.
- Plasma helps in regulating body temperature.
- Small amounts of oxygen are also carried by plasma.
- Most of the 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 cells (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 micrometer.

Formation of RBC,s :

In the embryonic stage, RBCs are 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 RBCs when formed have nucleus, mitochondria, endoplasmic reticulum and other cell organelles but these lost with maturation. About 95% of RBCs are composed of hemoglobin and 5% is of enzymes , salts and other proteins.

Haemoglobin:

RBCs contain red pigment called hemoglobin.

Average life span of RBC,s :

The average life span of RBC is about 120 days.

Destruction:

RBCs are destroyed in spleen and liver. About 2.5 million of RBCs are destroyed at every second in the body.

Function:

It transports oxygen from lungs to all parts of the body.

2. White blood cells (Leucocytes):**Shape:**

White blood cells are colorless and are nucleated blood cell. They are irregular in shape.

Size:

They are larger than RBCs. There are 1 or 2 leukocytes for every 1000 RBCs.

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 from 7 hours to maximum of 3 days.

Types : There are two main types of WBCs. 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 circulate 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 (Throm:bocytes):

Platelets are not true 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.

Color:

These are colorless because they have no pigment,

Number:

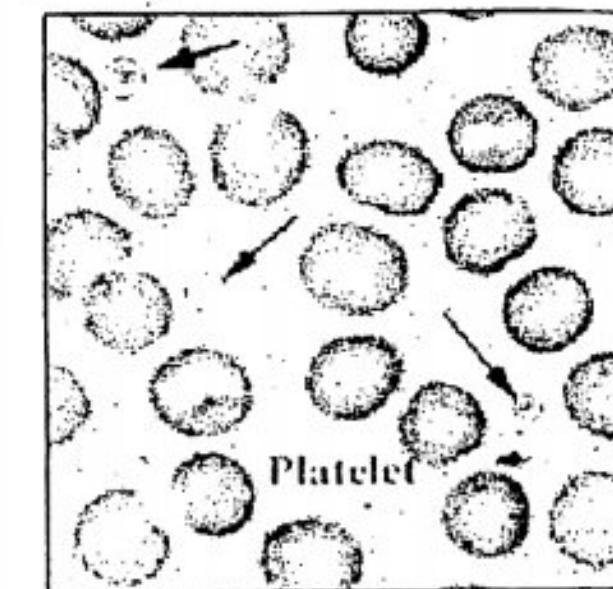
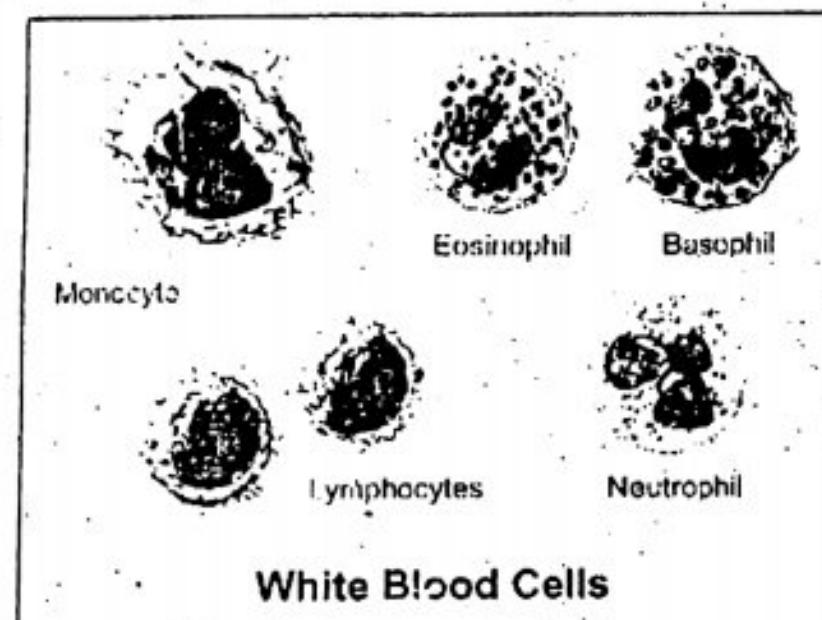
One cubic millimeter of blood contains 15,000 to 450,000 platelets.

Life span:

Their average life span is about 7 to 12 days.

Functions of platelets:

Platelets help in blood clotting. When a blood vessel rupture, the blood starts oozing out. Platelets gather around the site of infection and release substance which converts plasma protein into insoluble form fibrin. Fibrin makes a network in which platelets and other blood cells are entangled. Thus a clot is formed which stops the blood flow from the wound.

**Q11: Discuss disorders of blood.****1. Leukemia (Leukos -white, haema-blood):**

It is also called blood cancer.

Cause:

In this disease the number of WBCs increases abnormally and starts engulfing (eating) of RBC and Platelets.

Symptoms:

The abnormal cells also attack on bone marrow therefore the bones becomes soft, fragile and severe pain is produced in bones. A leukemia person suffers from 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 (thalassa 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:

Severe anemia, enlargement of spleen.

Treatment:

The blood is regularly replaced with normal blood.

Q 12 : Define Antigen and antibody ?**Ans: Antigen:**

Any substance which stimulates the production of antibody is called antigen.

Example:

Germ or any other foreign substance or toxins are different antigens.

Antibody:

The response of WBCs to produce a specialized type of protein against antigen to kill and destroy them called antibody.

Q 13: 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 RBCs but have both antibodies A & B.

Q 14: Discuss Blood Transfusion in ABO system?**Blood transfusion:**

The transfer of blood from healthy person to a patient is called blood transfusion.

Due to transfusion of opposite blood group clumping occurs in blood cells which cannot pass in microscopic blood capillaries and it cause death. The same is true for a person with blood group B transfused with blood group A. Anti-A antibody present in recipients blood will coagulate with RBCs having antigen A of donated blood.

ABO Blood Groups				
Antigen (on RBC)	Antigen A	Antigen B	Antigens A + B	Neither A or B
Antibody (in plasma)	Anti-B Antibody Y Y Y	Anti-A Antibody Y Y Y	Neither Antibody	Both Antibodies Y Y Y
Blood Type	Type A Cannot have B or AB blood Can have A or O blood	Type B Cannot have A or AB blood Can have B or O blood	Type AB Can have any type of blood Is the universal recipient	Type O Can only have O blood Is the universal donor

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 another antigen called Rh factor or Rh antigen (first discovered in Rhesus monkey) on RBCs.

Positive or negative blood group:

If Rh factor present on RBCs blood group will be positive. If Rh factor is absent on RBC, 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 receives 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-

Q 15 : Describe the structure of human heart 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 force the blood to right ventricle 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 semilunar 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 or 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.

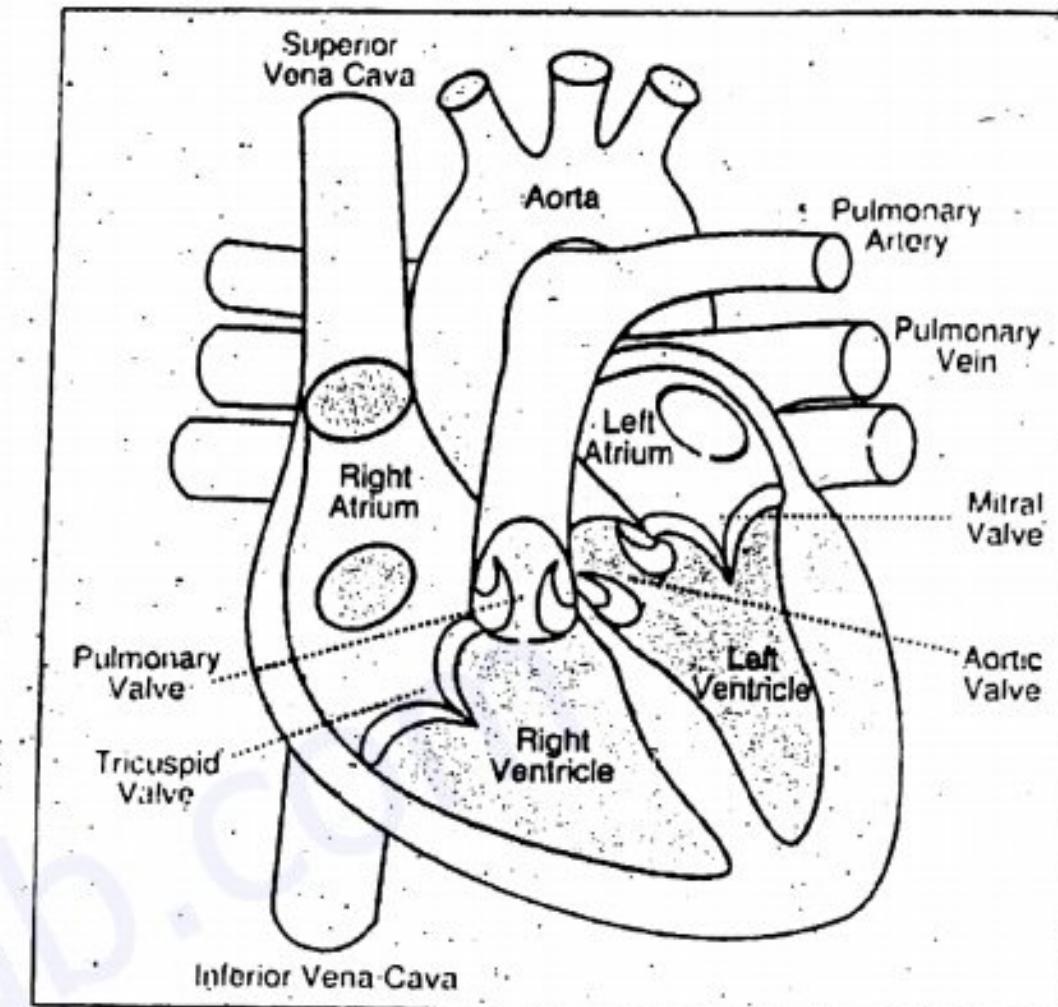
b. **Pulmonary vein:** This artery transport oxygenated blood from both lungs to heart.

2. Systemic blood circulation:

The pathway on which oxygenated blood is carried from heart to the body tissues and in return deoxygenated blood is carried from body tissue to the heart 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.

**Q 16: 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 consist of following steps;

Cardiac diastole:

In cardiac diastole i.e. auricle and ventricles relax and heart is filled with blood. During diastole "dubb" sound is produced due to the closing of semilunar valves. Semilunar close due to relaxation of ventricles.

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 ventricular systole lubb sound is produced due to closing of tricuspid and bicuspid valve.

Cardiac diastole = 0.4 seconds.
 Atrial systole = 0.1 seconds
 Ventricle systole = 0.3 seconds

Q 17: Write a note on pulse rate?
Pulse:

A pulse is a series of expansion waves in an artery caused 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 close 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 areas 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 of blood circulatory system that transport 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 vessels carry oxygenated blood from heart to various organs of the body except Pulmonary artery that carries deoxygenated blood to lungs for oxygenation.

Color:

Arteries are bright red in color due to the presence 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):

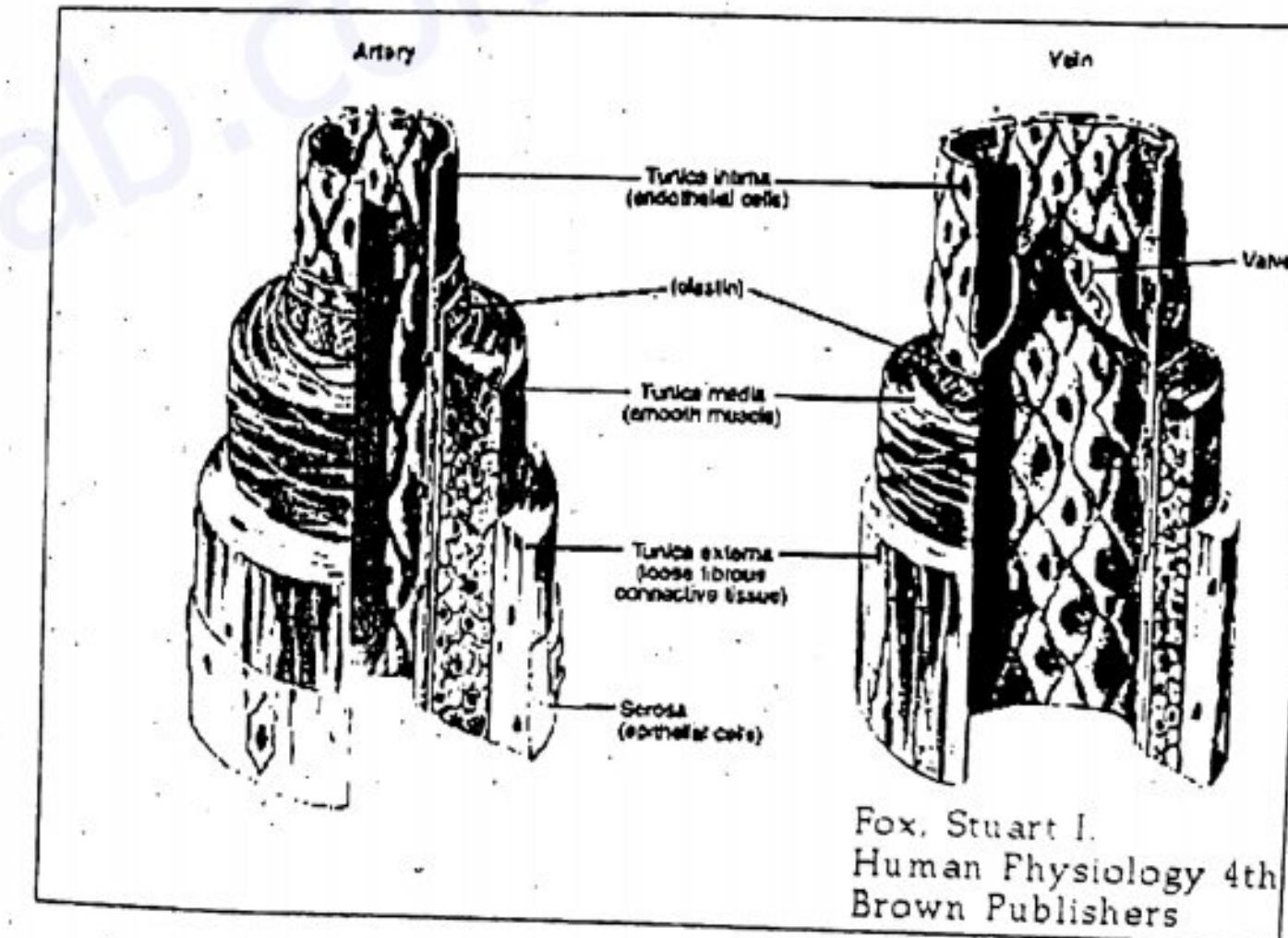
This layer allows arteries to expand and withstand high blood pressure. It is composed of connective tissue.

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.

Arteriole:

Smallest arteries in the body are called arterioles. These 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. Their diameter is about 8 to 10 micrometer.

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 blood back from body organs to heart. Veins carry deoxygenated blood from all parts of the body toward heart except pulmonary vein which carries oxygenated blood from lungs to heart.

Color:

Veins are blue in color due to the presence of deoxygenated blood.

Structure:

The walls of veins 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.

Vena Cava:

Largest veins in the body is called Vena cava. Superior vena cava brings deoxygenated blood from head and upper region of the body and inferior vena cava brings deoxygenated blood from lower part of the body.

Venule:

The smallest veins in the body are called venule.

Q.19: Name major arteries and veins and discuss the organ to which they target?

Ans: The human circulatory system consists of two sub systems.

- (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 runs upward along trachea and supply oxygenated blood to head region.

d) Subclavian artery:

It supplies oxygenated blood to arms.

e) Coeliac artery:

It supplies oxygenated blood to the stomach and spleen.

f) Mesenteric artery:

It supplies oxygenated blood to the digestive organs like pancreas, duodenum and rectum etc.

g) Hepatic artery:

It supplies oxygenated blood to the liver.

h) 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.

Venacave:

These are the largest veins of the body. It consist,

a) Superior vena cava:

Superior vena cava is formed by the union of many pair of veins from head, shoulders and arms.

b) Inferior venacava:

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.

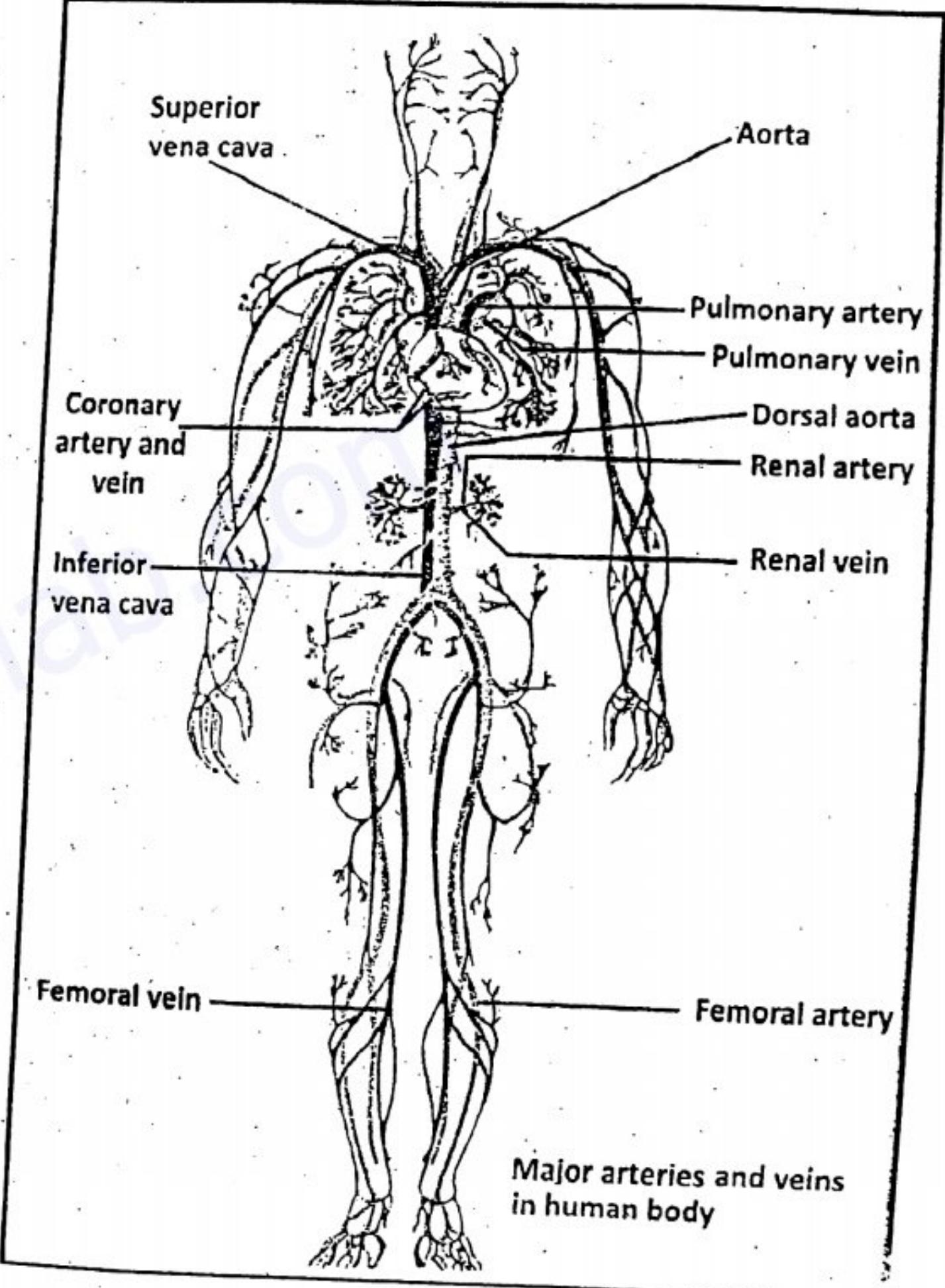
g) Mesenteric vein:

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.



Q 20: Discuss the discovery of blood circulation?

Ans: Pioneers of discovering blood circulation are Ibn-Al-Nafees and William Harvey. Many other names are also included in the list but the contributions 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 Al-Nouri 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 that 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 describe 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.

**Q 21: 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 causes of death in the world.

i. Atherosclerosis: (Gr: athero- grout, skelerosis - harden):

The diseases of the arteries occur 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 (high Blood Pressure)
- Smoking
- Diabetic mellitus.(High blood sugar)
- Increased lipid level (high cholesterol 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 expand during systole. This inflexibility of artery makes the heart to work harder.

Causes:

- Increasing age
- Severe 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

EXERCISE

MULTIPLE CHOICE QUESTIONS

A. Encircle the best suitable answers

SHORT QUESTIONS

Q 1: Why does a RBC lack cellular organelles?

Ans : Reason of lack of organelles in RBC:

RBCs are specialized cells. About 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 nucleas and other cellular organelles.

Q 2: Is the rate of transpiration higher on a sunny day or a rainy day? Why?

Ans: Rate of transpiration:

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.

Q 3: What will happen to transpiration stream if the air is injected in xylem vessels?

Ans: Effect of injection of air in xylem vessels on transpiration:

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.

Q 4: What is translocation of food in plants?

Ans: See Q No 9

Q 5: What is transpiration pull? Describe the importance of transpiration in the life of the plant?

Ans: See Q No 8

Q 6: How does the pressure-flow theory explain the movement of sugars through phloem vessels of a plant?

Ans: See Q No 9

Q 7: Describe the composition of human blood. What are the main functions of blood cells?

Ans: See Q No.10

Q 8: How are different blood groups formed. What is their practical implication in blood transfusion?

Ans: See Q No.13

Q 9: 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: Effect of water deficiencies on volume of blood vessels:

Blood plasma is composed of 90 % of water. In the month of June due to high temperature sweating occurs. 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.

Q 10: Write any four differences between xylem and phloem?

Characteristics	Xylem	Phloem
Cell living/Dead	Three dead cells (Vessel, trachids, xylem fibre) 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 QUESTIONS

Q 1: Draw the internal structure of a human heart and show the blood circulation with the help of arrows.

Ans: See Q No. 15

Q 2: Discuss the function of major arteries and veins.

Ans; See Q No. 19

Q 3: Discuss transpiration and its importance?

Ans; See Q No. 3 & 6

Q 4: 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.

ADDITIONAL MULTIPLE CHOICE QUESTIONS

1. Loss of water in the form of vapours from the aerial parts of plants is called
a) Circulation b) vaporization c) Transpiration d) none
2. Leaves are modified into thorns in
a) Xerophytes b) mesophytes c) hydrophytes d) halophytes
3. The pressure flow theory was presented by
a) läveran b) schleiden c) schawan d) Ernst Munch
4. Plasma form _____ volume of the blood.
a) 45 % b) 55 % c) 60% d) 65 %
5. Blood cells form _____ of volume of the blood.
a) 45% b) 55 % c) 60% d) 65 %
6. Plasma contain _____ water.
a) 70% b) 80% c) 90 % d) .95 %
7. The most numerous cells in blood is
a) RBCs b) WBCs c) platelets d) none of these
8. pH of human blood is
a) 7.1 b) 7.2 c) 7.3 d) 7.4

9. Red blood cells are red in colour due to the presence of red pigment.
a) Haemoglobin b) myglobine c) myosin d) actin
10. One cubic millimeter of blood contain
a) 4 millions b) 5 million c) 6 million d) 7 million
11. The average life span of RBC is
a) 100 days b) 110 days c) 120 days d) 130 days
12. Cytoplasm of RBC contain _____ % haemoglobin
a) 90% b) 95 % c) 97 % d) 98%
13. Single RBC contain _____ molecules of haemoglobin
a) 2 billion b) 3 billion c) 4 billion d) 5 billion
14. Life span of WBC is
a) 7 hours to 3 days b) 7 hours to 4 days
c) 7 hours to 5 days d) 8 hours to 5 days.
15. There are _____ different types of WBCs.
a) Four b) five c) three d) six
16. Which are defending our body from disease causing microorganism?
a) RBC,s b) platelets c) WBC,s d) megakaryocytes
17. _____ help in blood clotting.
a) Platelets b) RBCs c) WBC,s d) haemoglobin
18. WBC,s increase abnormally in
a) thalassaemia b) anaemia
c) leukemia d) haemophilia
19. A defective mechanism of producing haemoglobin is
a) Thalasaemia b) leukemia
c) anaemia d) haemophilia
20. Universal donor blood group is
a) A b) AB c) B d) O
21. Universal acceptor blood group is
a) A b) AB c) B d) O
22. Heart is made of
a) Smooth muscle b) skeletal muscles
c) Both A & B d) cardiac muscles
23. Which part of the human heart receives oxygenated blood?
a) Right atrium b) left atrium
c) right ventricle d) left ventricle
24. Aorta arise from
a) Right atrium b) left atrium
c) right ventricle d) left ventricle
25. One complete heart cycle takes.
a) 0.7 m b) 0.8 sec c) 0.8 m d) 0.9 sec

26. Normal rate of heartbeat in a healthy human being is _____ times per minutes.
 a) 72 b) 74 c) 76 d) 78
27. The largest artery of the body is
 a) Aorta b) pulmonary artery
 c) Subclavian artery d) none of them
28. The artery which supply oxygenated blood to head region is
 a) Subclavian artery b) pulmonary artery
 c) Carotid artery d) iliac artery
29. The artery which supply oxygenated blood to legs.
 a) Subclavian artery b) pulmonary artery
 c) Carotid artery d) iliac artery
30. Hepatic artery supplies oxygenated blood to
 a) Stomach b) liver c) intestine d) heart
31. Every year 28th September is celebrated as
 a) AIDS day b) heart day c) Polio day d) cancer day

THE TERMS TO KNOW

Transport	Antibodies	Angia pectoris
Transpiration	Cardiac cycle	Lumen
Guard cells	Pulse	Coronary artery
Pericycle	Cardiac cycle	Leukemia
antigen	Myocardial infraction	thalassemia

~~dated~~ in universal Declaration of human Right
by united nations.

Total time: 3:00 Hours

MRD-IX -19 (A)

Total Marks: 65

Biology (9th)

VERSION : A

Note : There are three sections in this paper i.e Section A, B & C

Time Allowed: 20 Minutes

"Section-A"

Marks: 12

Instructions:

- Attempt this section on the MCQs Answer Sheet only
- Use black ball point or marker for shading only one circle for correct option of a question.
- No mark will be awarded for cutting, erasing, over writing and multiple circles shading.

Q.1. Choose the correct option i.e., A,B,C or D.

1. The branch of biology which deals with study of cells and their organelles is called
 a. Anatomy b. Taxonomy c. Histology d. cytology
2. One of the following is not a macromolecule.....
 a. Glucose b. Sucrose c. Fatty acid d. Protein
3. For the first time, who found plasmodium in the blood of malarial patient?
 a. Ronald Ross b. Laveran c. A.F.A king d. Mendal
4. A new kingdom i.e Protista was proposed by
 a. Whittaker b. Linnaeus c. Aristotle d. Ernst Hacekal
5. Maximum biodiversity is found in
 a. Forests b. Grasslands c. Desserts d. Mountains
6. the magnification of light microscope is
 a. 1000 X b: 500 X c. 1500 X d. 2000 X
7. Nervous tissue is composed of nerve cells which are called
 a. Nephrons b. Axon c. Dendron d. Neuron
8. During which phase of meiosis, crossing over occurs?
 a. Prophase-I b. Metaphase-I c. Anaphase-I d. Telophase-I
9. Pepsin in the stomach work best at a pH of
 a. 2 b. 8 c. 9 d. 10
10. A car engine uses fuel for work to do. To carry out functions, a living cell uses.....
 a. Electric power b. Generator c. Heat energy d. ATP
11. Which of the following does not manufacture digestive juices?
 a. Esophagus b. Stomach c. Pancreas d. Intestine
12. The cells which form platelets are
 a. Erythrocytes b. Leucocytes c. Bone marrow cells d. All of these

Total time: 2:40 Hours

Biology (9th)

Total Marks: 53

“Section- B”

Q 2: Attempt any eight (8) parts of the following. Each part carries equal marks. Marks:32

- Thus the lengthy spanner will lose a rusty*
- i. Write the contribution of Abdul Malik Asmai in the field of biology.
 - ii. Differentiate between inductive reasoning and deductive reasoning.
 - iii. Define gene and species.
 - iv. List all parts (in order) of the human digestive system through which food actually passes.
 - v. Describe four major reasons for deforestation.
 - vi. State what is Plasmolysis and Deplasmolysis?
 - vii. Write the significance of mitosis.
 - viii. Describe the effect of pH on enzyme activity.
 - ix. Write the importance of turgor in plants.
 - x. Compare aerobic respiration with anaerobic respiration.
 - xi. Enlist four environmental hazards related to use of fertilizer.



“Section- C”

Note: Attempt any three (3) questions. Each question carries equal marks. Marks:21

- Q 3. (a) Explain binomial nomenclature. What are its advantages?
(b) What are Bio-elements? Name them.
- Q 4. (a) Differentiate between eukaryotic and prokaryotic cells.
(b) Draw labeled diagram of chloroplast.
- Q 5. (a) Describe the structure and function of large intestine of human digestive system.
(b) Differentiate between mitosis and meiosis?
- Q 6. (a) Explain the mechanism of enzyme action by Lock and Key model.
(b) Write a short note on Thalassaemia.