XI– BIO-BOTANY

Name :

Class : Sec :

School :

INDEX

BLUE STARS HR. SEC. SCHOOL

XI - BIO – BOTANY

UNIT – I DIVERSITY OF LIVING WORLD

Chapter – 1 LIVING WORLD

I. Fill ups:

1. Which one of the following statement about virus is correct **they contain DNA or RNA**

2. Identify the incorrect statement about the Gram positive bacteria **Teichoic acid absent**

3. Identify the Archaebacterium**Methanobacterium**

4. The correct statement regarding Blue green algae is **lack of motile structures**

5. Identify the correctly matched pair **Bacteria – Crown gall**

II. Answer the following :

6. Differentiate Homoiomerous and Heteromerous lichens.

Homoiomerous	Heteromerous
Algal cells evenly distributed in the thallus	A distinct layer of algae and fungi present

7. Write the distinguishing features of Monera.

i. This kingdom includes all prokaryotic organisms. Example : Mycoplasma, bacteria, actinomycetes and cyanobacateria.

ii. These are microscopic. They do not have a true nucleus and membnrane bound organelles.

iii. Many other bacteria like Rhizobium, Azotobacter and Clostridium can fix atmospheric nitrogen into ammonia.

iv. Some bacteria are parasites and others live as symbionts.

8. Briefly discuss on five kingdom classification.

Five Kingdom Classification :

R.H.Whittaker, an American taxonomist proposed five kingdom classification in the year 1969. The Kingdoms include **Monera, Protista, Fungi, Plantae andAnimalia**.

The criteria adopted for the classification include cell structure, thallus organization, mode of nutrition, reproduction and phylogenetic relationship**.**

Criteria	Kingdom				
	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Level of organization	Mostly Unicellular, rarely multicellur	Unicellular	Multicellular and unicellular	Tissue/organ	Tissue/organ/organ system
Cell wall	Present (made up of Peptidoglycan and Mucopeptides)	Present in some (made up of cellulose), absent in others	Present (made up of chitin or cellulose)	Present (made up of cellulose)	absent
Nutrition	Autotrophic (Phototrophic, Chemoautotrophic) Heterotrophic (parasitic and saprophytic)	Autotrophic-Photosynthetic, Heterotrophic	Heterotrophic-parasitic or Saprophytic	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic)
Motility	Motile or non-motile	Motile or non-motile	Non-motile	Mostly Non-motile	Mostly motile
Organisms	Archaebacteria, Eubacteria, Cyanobacteria, Actinomycetes and Mycoplasma	Chrysophytes, Dinoflagellates, Euglenoids, Slime molds, *Amoeba*, *Plasmodium*, *Trypanosoma*, *Paramecium*	Yeast, Mushrooms and Molds	Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms	Sponges, Invertebrates and Vertebrates

9. Write a note on merits and demerits of five kingdom classification.

Merits :

• The classification is based on the complexity of cell structure and organization of thallus.

• It is based on the mode of nutrition

• Separation of fungi from plants

• It shows the phylogeny of the organisms

Demerits :

• Viruses were not included in the system

• The kingdom Monera and protista accommodate both autotrophic and heterotrophic organisms, cell wall lacking and cell wall bearing organisms thus making these two groups more heterogeneous.

10. Why do farmers plant leguminous crops in crop rotations / mixed cropping ?

i. Legumes have bacteria on nodules which are on the roots of the plants. The bacteria on the nodules takes nitrogen from the air and fixes it into the soil, so that other plants that require nitrogen can use it as well.

ii. Rotation of crops improves the fertility of the soil and hence brings about an increase in the production of food grains.

iii. iii. Rotation of crops helps in saving on nitrogenous fertilizers, because leguminous plants grow during the rotation of crops can fix atmospheric nitrogen in the soil with the help of nitrogen fixing bacteria.

iv. Crop rotation adds diversity to an operation.

11. Give a general account on lichens.

A lichen is a composite organism that arises from algae or cyanobacteria living among filaments of multiple fungi species in a mutualistic relationship. The combined lichen has properties different from those of its component organisms. Lichens come in many colors, sizes, and forms.

UNIT – I DIVERSITY OF LIVING WORLD

Chapter – 2 PLANT KINGDOM

I. Fill ups:

1. Which of the plant group has gametophyte as a dominant phase? **Bryophytes**
2. Which of following represent gametophytic generation in pteridophytes? **Prothllus**
3. The haploid number of chromosome for an angiosperm is 14, the number of chromosome in its endosperm would be **42**
4. Endosperm in gymnosperm is formed **before fertilization**

II. answer the following :

1. **Differentiate halpontic and diplontic life cycle?**

S.No	Haipontic	Diplontic cycle
1.	Gametophyte is dominant	Sporophyte is dominant
2.	Sporophyte is represented by zygote	Gametophyte is represented by few cell gametophyte

2. What is Plectostele? Give example?

Plectostele : Xylem plates alternates with phloem plates.

Example :Lycopodiumclavatum

3. What do you infer from the term Pycnoxylic?

Pycnoxylic wood is compact with narrow medullary ray.

Example :Pinus

4. **Mention two characters shared by Gymnosperm and Angiosperm?**

S.No	Gymnosperms	Angiosperms
1.	Vessels are absent (except Gnetales)	Vessels are present
2.	Phloem lacks companion cells	Companion cells are present

5. Do you agree with the statement 'Bryophytes need water for fertilization'? Justify your answer?

Yes, in Bryophytes, water plays a vital role in fertilization, since water film is needed for the transfer of spermatium (male sex cell) to the egg cell.

6. Do you think shape of chloroplast is unique for algae. Justify your answer.

Variation among the shape of the chloroplast is found in members of algae. It is cup shaped (chlamydomonas). Discoied (Chara), Girdle shaped (Ulothrix), reticulate (Oedogonium), spiral (Spirogyra), stellate (Zygnema) and plate like (Mougeoutia).

UNIT – II PLANT MORPHOLOGY AND TAXONOMY OF ANGIOSPERM

Chapter – 3 VEGETATIVE MORHOLOGY

I. Fill ups :

1. Roots are **descending, positively geotrophic, negatively phototrophic.**

2. Bryophyllum and Dioscorea are example for **foliar bud, cauline bud.**

3. Which of the following is polycarpic plant?**Magnifera**

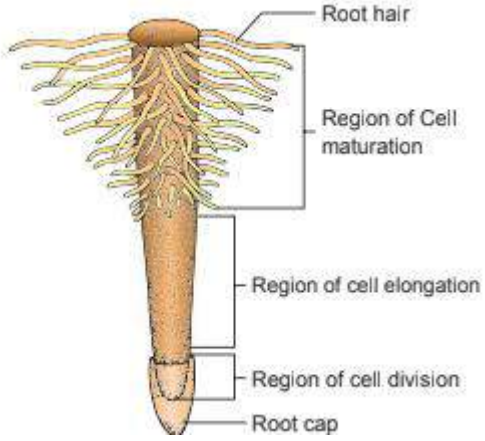
II. Choose the correct answer :

1. Which of the following is the correct statement?
   a)**In Pisum sativum leaflets modified into tendrils**
   b) In Atalantia terminal bud is modified into thorns
   c) In Nepenthes midrib is modified into lid
   d)In smilax inflorescence axis is modified into tendrils

2. Select the mismatch pair
   a. Musa - Unicostate
   b. Lablab-Trifoliolate
   c. Acalypha-Leaf mosaic
   d. Allamanda-Ternate phyllotaxy

III. Answer the following :

1. **Draw and label the parts of region of root.**



2. **Write the similarities and differences between**
   a) Avicennia and Trapa
   b) Radical buds and Foliar buds

c) Phyllocade and Cladode

	Avicennia	**Trapa**
Similarity	Aquatic plant	Aquatic plant
Difference	Produces respiratory roots. Eg: Mangrove plant.	Do not produce respiratory roots. Eg: free floating plants.

	Radical buds	**Foliar buds**
Similarity	It is a type of Adventitious bud	It is a type of Adventitious bud
Difference	Radical buds develop from roots. Eg: sweet potato	Foliar buds develop from leaf notches. Eg: Bryophyllum

	Phyllocade	**Cladode**
Similarity	Stem and branches are modified for photosynthesis	Stem and branches are modified for photosynthesis
Difference	It has unlimited or indefinite growth.Eg:Opuntia	It has limited or definite growth.Eg:Ruscus aculeatus

3. How root climbers differ from stem climbers?

Root climbers	**Stem climbers (twiners)**
Plants climbing with the help of adventitious roots (arise from nodes) Ex: Piper betel	These climbers lack specialized structure for climbing and the stem itself coils around the support. Ex: Ipomoea

4. Compare sympodial branching with monopodial branching?

Sympodial branching	**Monopodial branching**
The terminal bud cease to grow after a period of growth and the further growth is taken care by successive or several lateral meristem or buds. This types of growth is also known as sympodial branching. Ex: Cycas.	The terminal bud grows uninterrupted and produce several lateral branches. This type of growth is also known as monopodial branching. Ex: Polyalthia

5. Compare pinnate (or)unicostate venation and palmate (or)multicostate venation?

Pinnate (or) unicostate venation	**palmate (or) multicostate venation**
In pinnate or unicostate there is only one prominent midrib.	In palmate (or) multicostate there are many midribs running parallel to each other.

UNIT – II PLANT MORPHOLOGY AND TAXONOMY OF ANGIOSPERM

Chapter – 4 REPRODUCTIVE MORPHOLOGY

I. Fill ups :

1. Vexillary aestivation is characteristic of the family **Fabaceae**
2. Gynoecium with united carples is termed as **syncarpous**
3. Aggregate fruit developes from **multicarpellary, apocarpous ovary**
4. In an inflorescence, where flowers are borne laterally in an acropetal succession the position of the youngest floral bud shall be **distal**
5. A ture fruit is the one, where **only ovary of the flower develops into fruit**

II. Answer the following :

1. Find out the floral formula for a bisexual flowers with bract, regular, pentamerous, distinct calyx and corolla, superior ovary without bracteole?

Br, ebrl, ♂, ⊕ , $k_{(5)}$, $C_{(5)}$, $A_{(5)}$, $\underline{G}_{(5)}$

2. Give the technical terms for the fllowing:

a) A sterile stamen
b) Stamens are united in one bunch
c) Stamens are attached to the petals

a) A sterile stamen - Staminode
b) Stamens are united in one bunch - Monadelphous
c) Stamens are attached to the petals - Epipetalous (petalostemonous)

3. Explain the different types of placentation with example?

a) Marginal :
It is with the placentae along the margin of a unicarpellate ovary. Ex: Fabaceae.

b) Axile :
The placentae arises from the column in a comound ovary with septa. Ex: Hibiscus, Tomato and lemon.

c) Superficial :
Ovules arise from the surface of the septa. Ex :Nymphaeceae.

d) Parietal :
It is the placentae on the ovary walls or upon intruding partitions of a unilocular, compound ovary. Ex : Mustard, argemone and cucumber.

e) Free – central :It is with the placentae along the column in a compound ovary without septa. Ex:Caryophyllaceae, Dianthus and primrose.

f) Basal :

It is the placenta at the base of the ovary. Ex : Sunflower (Asteraceae), Marigold.

4. Differentiate between aggregate fruit with multiple fruit?

Aggregate Fruits :

Aggregate fruits develop from a single flower having an apocarpous pistil. each of the free carpel is develops into a simple fruitlet. A collection of simple fruitlets makes an **aggregate fruit**. An individual ovary develops into a drupe, achene, follicle or berry. An aggregate of these fruits borne by a single flower is known as an **etaerio**. Example: *Magnolia*, Raspberry, *Annona, Polyalthia*

Multiple or Composite Fruit :

A Multiple or composite fruit develops from the whole inflorescence along with its peduncle on which they are borne.

a) Sorosis: Afleshy multiple fruit which develops from a spike or spadix. Th e flowers fused together by their succulent perianth and at the same time the axis bearing them become fleshy or juicy and the whole inflorescence forms a compact mass. Example: Pineapple, Jack fruit, Mulberry

b) **Syconus**: A multiple fruit which develops from hypanthodium inflorescence. The receptacle develops further and converts into fleshy fruit which encloses a number of true fruit or achenes which develops from female flower of hypanthodium inflorescence. Example: *Ficus*

5. Explain the different types of fleshy fruit with suitable example?

A. Fleshy Fruit :

The fruits are derived from single pistil where the pericarp is fleshy, succulent anddifferentiated into epicarp, mesocarp and endocarp.

It is subdivided into the following.

a) Berry:

Fruit develops from bicarpellary or multicarpellary, syncarpous ovary. Here the epicarp is thin, the mesocarp and endocarp remain undifferentiated. They form a pulp in which the seeds are embedded. Example: Tomato, Date Palm, Grapes, Brinjal.

b) Drupe:

Fruit develops from monocarpellary, superior ovary. It is usually one seeded. Pericarp is differentiated into outer skinny epicarp, fleshy and pulpy mesocarp and hard and stony endocarp around the seed. Example: Mango, Coconut.

c) Pepo:

Fruit develops from tricarpellary inferior ovary. Pericarp terns leathery or woody which encloses, fleshy mesocarp and smooth endocarp. Example: Cucumber, Watermelon, Bottle gourd, Pumpkin.

d) Hesperidium:

Fruit develops from multicarpellary, multilocular, syncarpous, superior ovary. The fruit wall is diff erentiated into leathery epicarp with oil glands, a middle fi brousmesocarp. The endocarp forms distinct chambers, containing juicy hairs. Example: Orange, Lemon.

e) Pome:

It develops from multicarpellary, syncarpous, inferior ovary. The receptacle also develops along with the ovary and becomes fleshy, enclosing the true fruit. In pome the epicarp is thin skin like and endocarp is cartilagenous. Example: Apple, Pear.

f) Balausta:

A fleshy indehiscent fruit developing from multicarpellary, multilocular inferior ovary whose pericarp is tough and leathery. Seeds are attached irregularly with testa being the edible portion. Example: Pomegranate.

UNIT – II PLANT MORPHOLOGY AND TAXONOMY OF ANGIOSPERM

Chapter – 5 TAXONOMY AND SYSTEMATIC BOTANY

1. Phylogenetic classification is the most favoured classification because it reflects **evolutuinary relationships**
2. The taxonomy which involves the similarities and dissimilarities among the immune system of different taxa is termed as **Serotaxonom**
3. Which of the following is a flowering plant with nodules containing filamentous nitrogen fixing micro – organisms? **Crotalaria juncea**
4. Flowers are zygomorphic in **Ceropegia**

I. Answer the following:

1. **What is the role of national gardens in conserving biodiversity – discuss?**
   Botanical gardens plays the following important roles :
   i. Gardens with aesthetic value which attract a large number of visitors. For example, the Great Banyan Tree (Ficusbenghalenis) in the Indian Botanical Garden at Kolkata
   ii. Gardens have a wide range of species and supply taxonomic material for botanical research
   iii. Garden is used for sefl-instruction or demonstration purposes.

2. **Where will you place the plants which contain two cotyledons with cup shaped thalamus?**
   Class : Dictyledonae
   Subclass : Polypetalae
   Series : Calyciflorae
3. **Give the floral characters of Clitoriaternatea?**
   Bracteate, bracteolate, bracteoles usually large, pedicellate, heterochlamydeus, complete, bisexual, pentamerous, zygomorhic, and hypogynous.

4. **How will you distinguish Solanaceae members from Liliaceae members?**

Characters	**Solanaceae members**	**Lilicee members**
Root	**Branched taproot**	**Adventitious fibrous root**
Stem	**Herbaceous**	**Bulbous/rhizomatous**
Leaf	**Reticulate venation**	**Parallel venation**
Inflorescence	**Solitary and axillary cyme**	**Simple or branched raceme**
Flowers	**Pentamerous**	**Trimerous**
Androecium	**Stamens 5, epipetalous**	**Stamens 6, epiphyllous**
Gynoecium	**Bicarpellary**	**tricarpellary**

UNIT – III CELL BIOLOGY AND BIOMOLECULES

Chapter – 6 CELL : THE UNIT OF LIFE

I. Fill ups :

1. The two subunits of ribosomes remain united at critical ion level of **magnesium**
2. Sequences of which of the following is used to know the phylogeny **Hn RNA**
3. Many cells function properly and divide mitotically even though they do not have. **Plastids**
4. Keeping in view the fluid mosaic model for the structure of cell membrane, which one of the following statements is correct with respect to the movement of lipids and proteins from one lipid monolayer to the other **while lipids can rarely flip-flop proteins cannot**
5. Match the columns and identify the correct option:

Column – I	Column – II	
a) Thylakoids	Disc – shaped sacs in golgi apparatus	**c**
b) Cristae	Condensed structure of DNA	**d**
c) Cisternae	Flat membranous sacs in stroma	**a**
d) Chromation	Infoldings in mitochondria	**b**

II. Answer the following :

1. **Bring out the significance of Transmission Electron Microscope?**

   Phase contrast microscope is used to observe living cells, tissues and the cells cultured invitro during mitosis.

2. **State the protoplasm theory?**

   Protoplasm theory was proposed by Max Schultze which states that the protoplasm is the living content of cell and is a complex colloidal system.

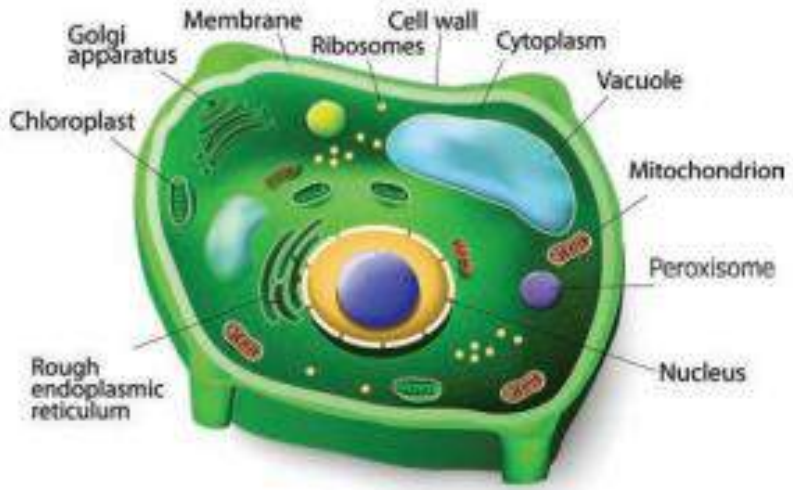
3. Distinguish between prokaryotes and eukaryotes?

Features	Prokaryotes	Eukaryotes
Size of the cell	~1-5µm	~10-100µm
Nuclear character	Nucleoid, no true nucleus,	True nucleus with nuclear membrane
DNA	Usually circular without histone proteins	Usually linear with histone proteins
RNA/Protein synthesis	Couples in cytoplasm	RNA synthesis inside nucleus/ Protein synthesis in cytoplasm
Ribosomes	50S+ 30S	60S + 40S
Organelles	Absent	Numerous
Cell movement	Flagella	Flagella and cilia
Organization	Usually single cell	Single, colonial and multicellular
Cell division	Binary fission	Mitosis and meiosis
Examples	Bacteria and Archaea	Fungi, plants and animals

4. Difference between plant and animal cell.

S. No	Plant cell	Animal Cell
1	Usually they are larger than animal cells	Usually smaller than plant cells
2	Cell wall present in addition to plasma membrane and consists of middle lamellae, primary and secondary walls	Cell wall absent
3	Plasmodesmata present	Plasmodesmata absent
4	Chloroplast present	Chloroplast absent
5	Vacuole large and permanent	Vacuole small and temporary
6	Tonoplast present around vacuole	Tonoplast absent
7	Centrioles absent except motile cells of lower plants	Centrioles present
8	Nucleus present along the periphery of the cell	Nucleus at the centre of the cell
9	Lysosomes are rare	Lysosomes present
10	Storage material is starch grains	Storage material is a glycogen granules

5. Draw the ultra structure of plant cell.



UNIT – III CELL BIOLOGY AND BIOMOLECULES

Chapter – 7 CELL CYCLE

I. Fill ups :

1. The correct sequence in cell cycle is **G1-S-G2-M**
2. If mitotic division is restricted in G1 phase of the cell cycle then the condition is known as **G0 phase**
3. Anaphase promoting complex APC is a protein degradation machinery necessary for proper mitosis of animal cell. If APC is defective in human cell, which of the following is expected to occure? **Chromosome will not condense**
4. In S phase of the cell cycle **amount of DNA doubles in each cell**
5. Centromere is required for **movement of chromosome towards pole**
6. Synapsis occur between **two homologous chromosomes**
7. In meiosis crossing over is initiated at **pachytene**
8. Colchicine prevents the mitosis of the cells at which of the following stage **metaphase**
9. The paring of homologous chromosomes on meiosis is known as **synapsis**

II. Answer the following :

1. Write any three significance of mitosis?

Exact copy of the parent cell is produced by mitosis (genetically identical)

i. Genetic stability –daughter cells are genetically identical to parent cells.
ii. Repair of tissues – damaged cells must be replaced by identical new cells by mitosis
iii. Regeneration – arms of star fish

2. Differentiate between Mitosis and Meiosis?

S.no	Mitosis	Meiosis
1.	One division	Two division
2.	Number of chromosomes remains the same	Number of chromosomes is halved
3.	Homologous chromosomes line up separately on the metaphase plate	Homologous chromosomes line up in pairs at the metaphase plate
4.	Homologous chromosome do not pair up	Homologous chromosome pairup to form bivalent
5.	Chiasmata do not form and crossing over never occurs	Chiasmata form and crossing over occurs
6.	Daughter cells are genetically	Daughter cells are genetically different from the parent cells
7.	Two daughter cells are formed	Four daughter cells are formed

3. Given an account of G0 phase.

Some cells exit G1 and enters a quiescent stage called **G0**, where the cells remain metabolically active without proliferation. Cells can exist for long periods in G0 phase. In G0 cells cease growth with reduced rate of RNA and protein synthesis. The G0 phase is not permanent. Mature neuron and skeletal muscle cell remain permanently in G0. Many cells in animals remains in G0 unless called on to proliferate by appropriate growth factors or other extracellular signals. G**0** cells are not dormant.

4. Differentiate Cytokinesis in plant cells and animal cells.

Cytokinesis in animal cells :

It is a contractile process. The contractile mechanism contained in contractile ring located inside the plasma membrane. The ring consists of a bundle of microfilaments assembled from actin and myosin. This fibril helps for the generation of a contractile force. This force draws the contractile ring inward forming a cleavage furrow in the cell surface dividing the cell into two.

Cytokinesis in plant cells :

Division of the cytoplasm often starts during telophase. In plants, cytokinesis cell plate grows from centre towards lateral walls centrifugal manner of cell plate formation. Phragmoplast contains microtubules, actin filaments and vesicles from golgi apparatus and ER. The glogi vesicles contains carbohydrates such as pectin, hemicellulose which move along the microtubule of the pharagmoplast to the equator fuse, forming a new plasma membrane and the materials which are placed their becomes new cell wall. The first stage of cell wall construction is a line dividing the

newly forming the middle lamella. Cellulose builds up on each side of the middle lamella to form the cell walls of two new plant ccells.

5. Write about Pachytene and Diplotene of Prophase I.

Pachytene:

At this stage bivalent chromosomes are clearly visible as tetrads. Bivalent of meiosis I consists of 4 chromatids and 2 centromeres. Synapsis is completed and recombination nodules appear at a site where crossing over takes place between non-sister chromatids of homologous chromosome.

Recombination of homologous chromosomes is completed by the end of the stage but the chromosomes are linked at the sites of crossing over. This is mediated by the enzyme recombinase.

Diplotene:

Synaptonemal complex disassembled and dissolves. The homologous chromosomes remain attached at one or more points where crossing over has taken place. These points of attachment where 'X' shaped structures occur at the sites of crossing over is called **Chiasmata**.

Chiasmata are chromatin structures at sites where recombination has been taken place. They are specialised chromosomal structures that hold the homologous chromosomes together.

Sister chromatids remain closely associated whereas the homologous chromosomes tend to separate from each other but are held together by chiasmata.

This substage may last for days or years depending on the sex and organism.

The chromosomes are very actively transcribed in females as the egg stores up materials for use during embryonic development.

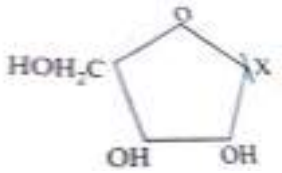
In animals, the chromosomes have prominent loops called **lampbrush chromosome**.

UNIT – III CELL BIOLOGY AND BIOMOLECULES

Chapter – 8 BIOMOLECULES

I. Fill ups :

1. The most basic amino acid is **arginine**
2. An example of feedback inhibition is allosteric inhibition of hexokinase by **glucose-6-phsphate**
3. Enzymes that catalyseinterconversion of optical, geometrical or positional isomers are **isomerases**
4. Proteins perform many physiological functions. For example some functions as enzymes. One of the following represents an additional function that some proteins discharge **hormones**
5. Given below is the diagrammatic representation of one of the categories of small molecular weight organic compounds in the living tissues. Identify the category shown and one blank component "X" in it



Nucleoside, uracil

II. Answer the following :

1. **Distinguish between nitrogenous base found in inorganic chemistry?**

Nitrogenous base	Base
Nitrogenous base are organic molecules containing the elements nitrogen and acts as a base in chemical reaction. Eg: Adenine, Thymine	Bases are the substance that release hydroxide (OH+) ions in aqueous solution. Eg: NaOH and Ca(OH)2

2. **Write the characteristic feature of DNA?**

• If one strand runs in the 5′-3′ direction, the other runs in 3′-5′ direction and thus are antiparallel (they run in opposite direction). The 5′ end has the phosphate group and 3'end has the OH group.
• The angle at which the two sugars protrude from the base pairs is about 120°, for the narrow angle and 240° for the wide angle. The narrow angle between the sugars generates a **minor groove** and the large angle on the other edge generates **major groove.**
• Each base is 0.34 nm apart and a complete turn of the helix comprises 3.4 nm or 10 base pairs per turn in the predominant B form of DNA.

• DNA helical structure has a diameter of 20 A° and a pitch of about 34 A°. X-ray crystal study of DNA takes a stack of about 10 bp to go completely around the helix (360°).

• Thermodynamic stability of the helix and specificity of base pairing includes (i) the hydrogen bonds between the complementary bases of the double helix (ii) stacking interaction between bases tend to stack about each other perpendicular to the direction of helical axis. Electron cloud interactions (Π – Π) between the bases in the helical stacks contribute to the stability of the double helix.

• Thephosphodiester linkages gives an inherent polarity to the DNA helix. They form strong covalent bonds, gives the strength and stability to the polynucleotide chain.

. Plectonemic coiling - the two strands of the DNA are wrapped around each other in a helix, making it impossible to simply move them apart without breaking the entire structure. Whereas in paranemic coiling the two strands simply lie alongside one another, making them easier to pull apart.

• Based on the helix and the distance between each turns, the DNA is of three forms – **A DNA, B DNA and Z DNA**

3. Explain the structure and function of different types of RNA?

• **mRNA (messenger RNA):** Single stranded, carries a copy of instructions for assembling amino acids into proteins. It is very unstable and comprises 5% of total RNA polymer. Prokaryotic mRNA (Polycistronic) carry coding sequences for many polypeptides. Eukaryotic mRNA (Monocistronic) contains information for only one polypeptide.

• **tRNA (transfer RNA):** Translates the code from mRNA and transfers amino acids to the ribosome to build proteins. It is highly folded into an elaborate 3D structure and comprises about 15% of total RNA. It is also called as **soluble RNA**.

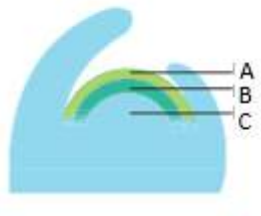
• **rRNA (ribosomal RNA):** Single stranded, metabolically stable, make up the two subunits of ribosomes. It constitutes 80% of the total RNA. It is a polymer with varied length from 120–3000 nucleotides and gives ribosomes their shape. Genes for rRNA are highly conserved and employed for phylogenetic studies

UNIT – IV PLANT ANATOMY (STRUCTURAL ORGANISATION)

Chapter – 9 TISSUE AND TISSUE SYSTE M

I. Fill ups :

1. Refer to the given figure and select the correct statement



i) A, B, and C are histogen of shoot apex iii) B Gives rise to cortex

2. Read the following sentences and identify the correctly matched sentences. **ii. In endarch condition, theprotoxylem lie towords the centre.iii. In centarch condition, metaxylemlies in the middle of theprotoxylem.iv. In mesarch condition, protoxylemlies in the middle of the metaxylem.**
3. In Gymnosperms, the activity of sieve tubes are controlled by **Nucleus of companion cell**
4. When a leaf trace extends from a vascular bundle in a dicot stem, what would be the arrangement of vascular tissue in the veins of the leaf? **Xylem would encircle the phloem**
5. Grafting is successful in dicots but not in monocots because the dicots have **cambium for secondary growth**

II. Answer the following :

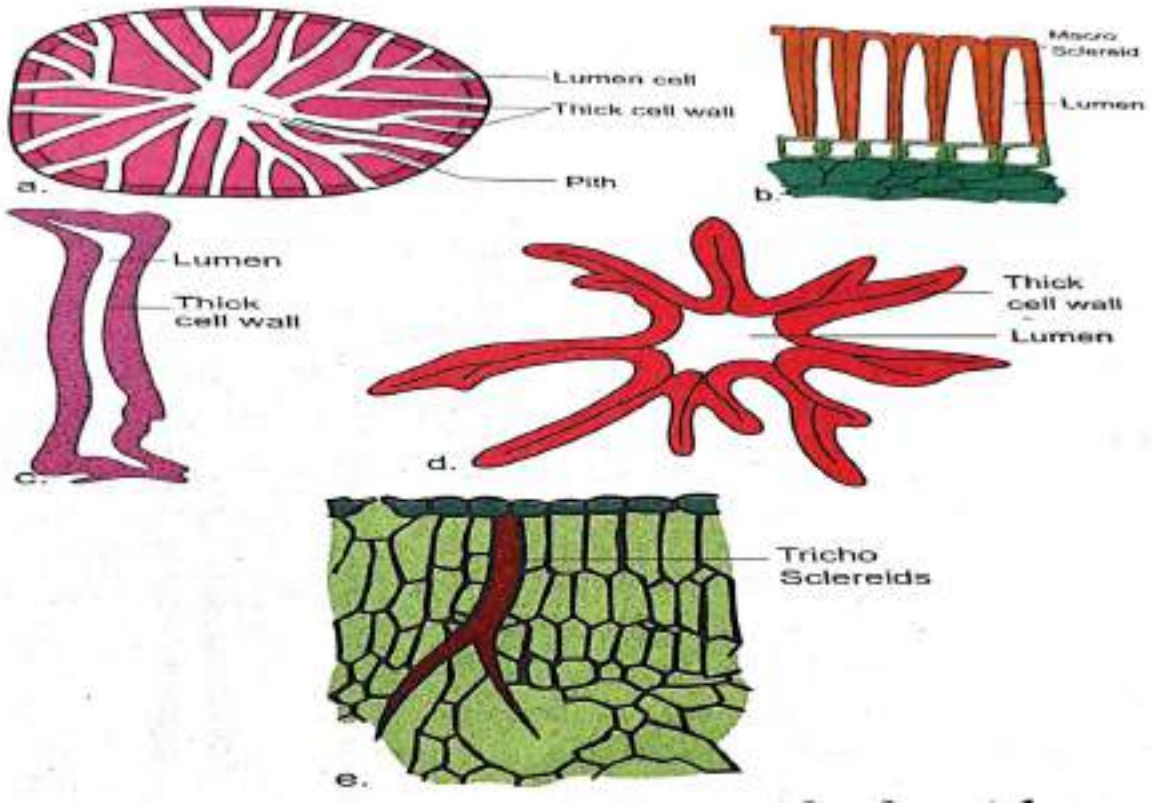
1. **Why the cells of sclerenchyma and tracheids be become dead?**

Tracheids and mature Sclerenchyma cells become dead due to the excessive secondary cell wall thickening composed of lignin. Due to this, the cell wall becomes hard and impermeable to water and other components essential for cell metabolism. Eventually, the cytoplasm is last, leaving lumen in centre.

2. **Explain sclereids with their types?**

1. **Branchysclereids or Stone cells:**
Isodiametric sclereids, with hard cellwall. It is found in bark, pith cortex, hard endosperm and fleshy portion of some fruits. Example: - Pulp of *Pyrus*.

2. **Macrosclereids:**
   Elongated and rod shaped cells, found inthe outer seed coat of leguminous plants.Example: *Crotalaria and Pisumsativum*.
3. **Osteosclereids (Bone cells):**
   Rod shaped with dilated ends. They occur in leaves and seed coats. Example: seed coat of *Pisumand Hakea*
4. **Astrosclereids:**
   Star cells with lobes or arms divergingform a central body. They occur in petiolesand leaves. Example: *Tea, Nymphae andTrochodendron*.
5. **Trichosclereids:**
   Hair like thin walled sclereids. Numeroussmall angular crystals are embedded in thewall of these sclereids, present in stems andleaves of hydrophytes. Example: *Nymphaealeaf* and Aerial roots of *Monstera*.



3. **What are sieve tube? Explain ?**

Sieve Elements :

Sieve elements are the conductingelements of the phloem. They are of twotypes, namely sieve cells and sieve tubes.

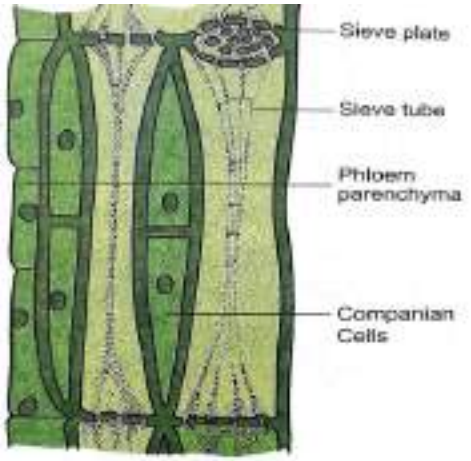
Sieve Cells :

These are primitive type of conductingelements found in Pteridophytes andGymnosperms. Sieve cells have sieve areas on their lateral walls only. They are not associated with companion cells.

Sieve Tubes :

Sieve tubes are long tube like conductingelements in the phloem. These are formed from a series of cells called sieve tube elements. The sieve tube elements are arranged one above the other and form vertical sieve tube. The end wall contains a number of pores and it looks like a sieve. So it is called as sieve plate. The sieve elements show nacreous thickenings on their lateral walls. They may possess simple or compound sieve plates Thefunction of sieve tubes are believed to be controlled by campanion cells.

In mature sieve tube, Nucleus is absent.It contains a lining layer of cytoplasm. A special protein (P. Protein = Phloem Protein) called slime body is seen in it. In mature sieve tubes, the pores in the sieve plate are blocked by a substance called **callose**(callose plug).The conduction of food material takes place through cytoplasmic strands. Sieve tubes occur only in Angiosperms.



4. Distinguish the anatomy of dicot root from monocot root?

S.No.	Characters	Dicot root	Monocot root
1.	Pericyle	Gives rise to lateral roots, phellogen and a part of vascular cambium.	Gives rise to lateral roots only.
2.	Vascular tissue	Usually limited number of xylem and phloem strips.	Usually more number of xylem and phloem strips,
3.	Conjunctive tissue	Parenchymatous; Its cells are differentiated into vascular cambium.	Mostly sclerenchymatous but sometimes parenchymatous. It is never differentiated in to vascular cambium.
4.	Cambium	It appears as a secondary meristem at the time of secondary growth.	It is altogether absent.
5.	xylem	Usually tetrach	Usually polyarch

5. Distinguish the anatomy of dicot stem from monocot stem?

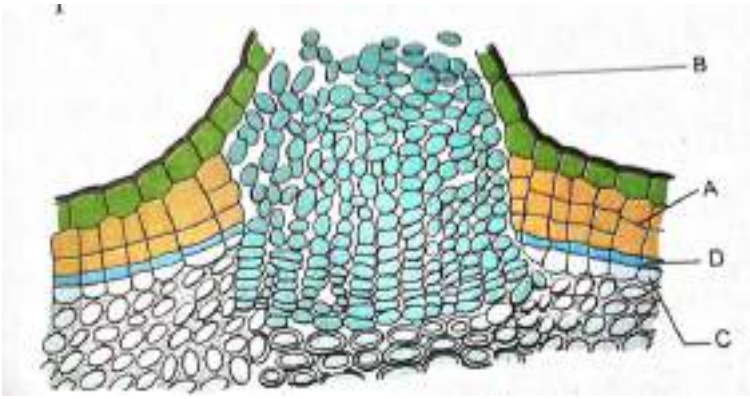
S.No.	Characters	Dicot Stem	Monocot Stem
1.	Hypodermis	Collenchymatous	Sclerenchymatous
2.	Ground tissue	Differentiated into cortex, endodermis and pericycle and pith	Not differentiated, but it is a continuous mass of parenchyma.
3.	Starch Sheath	Present	Absent
4.	Medullary rays	Present	Absent
5.	Vascular bundles	(a) Collateral and open	(a) Collateral and closed
		(b) Arranged in a ring	(b) Scattered in ground tissue
		(c) Secondary growth occurs	(c) Secondary growth usually does not occur.

UNIT – IV PLANT ANATOMY (STRUCTURAL ORGANISATION)

Chapter –10 SECONDARY GROWTH

I. Fill ups :

1. Consider the following statements:
   In spring season vascular cambium –
   i) Is less active
   ii) Produces a large numbers of xylem elements
   iii) Forms vessels with wide cavities of these
   Ans : (i) is not correct but (ii) and (iii) are correct
2. Usually, the monocotyledons do not increase their girth, because **they do not possess actively dividing cambium.**
3. In the diagram of lenticel identify the pas marked as A, B, C, D



A – Phellem, B – complementary tissue, C – phelloderm, D – phellogen

4. The common bottle cork is a product of **vascular cambium**
5. What is the fate of primary xylem in a dicot root showing extensive secondary growth? **It gets crushed**

II. Answer the following :

1. **In a forest, if the bark of a tree is damaged by the horn of a deer, how will the plant overcome the damage?**

   If the bark of a tree is damaged by the born of a deer, the tree first tries to seal the wound from outside environment to prevent any microbial infection. A reaction zone is created which alters the chemistry of the wood in the wounded area to avoid microbial infection. Than the tree builds a barrier zone 'Callus' to compartmentalize the wounded area. The callus grow and cover or seals the wound. This allows new uncontaminated wood to grow on it.

2. **In which season the vessels of angiosperms are larger in size, why?**

In spring season, the xylem vessels becomes larger sized with wide lime due to the active nature of cambium.

3. **Continuous state of dividing tissue is called meristem. In connection to this, what is the role of lateral meristem?**

Lateral meristem (vascular cambium and cork cambium) is responsible for the secondary growth of stemand roots.

4. **A timber merchant bought 2 logs of wood from a forest and named them A and B, the log A was 50 year old and B was 20 year old. Which log of wood will last longer for the merchant? Why?**

The wood log of 50 years old is durable since the heart wood of the plant gets harder and harder as the time moves, due to secondary growth.

5. **A transvers section of the trunk of a tree shows concentric rings which are known as growth rings. How are these rings formed? What are the significance of these rings?**

The activity of vascular cambium is under the control of many physiological and environmental factors.

In temperate regions, the climatic conditions are not uniform throughout the year. In the spring season, cambium is very active and produces a large number of xylary elements having vessels/ tracheids with wide lumen.

The wood formed during this season is called spring wood or early wood. The tracheary elements are fairly thin walled.

In winter, the cambium is less active and forms fewer xylary elements that have narrow vessels/tracheidsand this wood is called autumn wood or late wood.

UNIT – V PLANT PHYSIOLOGY (FUNCTIONAL ORGANISATION)

Chapter –11 TRANSPORT IN PLANTS

I. Fill ups :

1. In a fully turgid cell **DPD = 0 atm; OP = 10 atm; TP = 10 atm**

2. What type of transpiration is possiblein the xerophyte *Opuntia*?**Stomata**
3. Stomata of a plant open due a**Efflux of K_+**
4. Munch hypothesis is based on **translocation of food due to TP**
5. choose
Which among the following is correct?
a) apoplast is fastest and operate in nonliving part
b) Transmembrane route includes vacuole
c) symplast interconnect the nearby cell through plasmadesmata
d) symplast and transmembrane route are in living part of the cell

Ans : all are correct

II. Answer the following :

1. If the concentration of salt in the soil is too high and the plants may wilt even if the field is thorough irrigated. Explain.

High concentrations of salt in the soil leads to the wilting of plants due to phenomenon of plasmolysis taking place in the root cells.

Plasmolysis is a process in which when a plant cell is kept in a hypertonic solution, (here soil) water leaves the cell due to exosmosis.

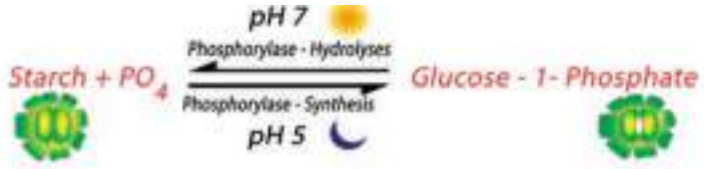
Due to this water loss, protoplasm shrinks and the cell membrane is pulled away from cell wall and finally becomes flaccid.

2. How phosphorylase enzyme open the stomata in starch sugar interconversion theory?

The discovery of enzyme phosphorylase in guard cells by Hanes (1940) greatly supports the starch-sugar interconversion theory.

The enzyme phosphorylase hydrolyses starch into sugar and high pH

followed by endosmosis and the opening of stomata during light.the vice versa takes plac during the night.



3. List out the non- photosynthetic parts of a plant that need a supply of sucrose?

Roots, buds, flowers, fruit and matured stem.

4. What are the parameters which control water potential?

Water potential (Ψ) can be determined by,

i) Solute concentration or solute potential (Ψs)

ii) Pressure potential (Ψp)

By correlating two factors, water potential is written as,

$\Psi w = \Psi s + \Psi p$

Water potential = solute potential + pressure potential

5. An artificial cell made of selectively permeable membrane immersed in a beaker (in the figure). Read the values and answer the following questions?

a. Draw an arrow to indicate the direction of water movement

b. Is the solution outside the cell isotonic, hypotonic or hypertonic?

c. Is the cell isotonic, hypotonic or hypertonic?

d. Will the cell become more flaccid, more turgid or stay in original size?

e. With reference to artificial cell state, the process is endosmosis or exosmosis?give reason

ANS:a)

b) Hypertonic

c) Hypotonic

d) More turgid

e) Since Ψw = -8, this process is endosmosis

UNIT – V PLANT PHYSIOLOGY (FUNCTIONAL ORGANISATION)

Chapter –12 MINERAL NUTRITION

I. Fill ups :

1. Identify correct match.

1. Die back disease of citrus	- (i) Mo	**2**
2. Whip tail disease	- (ii) Zn	**4**
3. Brown heart of turnip	- (iii) Cu	**1**
4. Little leaf	- (iv) B	**3**

2. If a plant is provided with all mineral nutrients but, Mn concentration is increased, what will be the deficiency? **Mn prevent the uptake of Fe, Mg but not Ca**

3. The element which is not remobilized? **Calcium**

4. Match the correct combination.

Minerals	**Role**	
A Molybdenum	1 Chlorophyll	**C**
B Zinc	2 Methionine	**D**
C Magnesium	3 Auxin	**B**
D Sulphur	4 Nitrogenase	**A**

5. Identify the correct statement

i. Sulphur is essential for amino acids Cystine and Methionine
ii. Low level of N, K, S and Mo affect the cell division
iii. Non-leguminous plant Alnuswhich contain bacterium *Frankia*
iv. Denitrification carried out by nitrosomonas and nitrobacter.

Ans : I, II, III are correct

II. Answer the following :

6. The nitrogen is present in the atmosphere in huge amount but higher plants fail to utilize it. Why?

Though nitrogen is abundant in atmosphere, plants does not have the ability to directly absorb the molecular nitrogen (N2) in atmosphere. So it has to be converted to absorbable from like nitrates (NO3-) and nitrites (NO2-) by nitrogen fixation. So that they can be utilized by plants.

7. Why is that in certain plants deficiency symptoms appear first in younger parts of the plants while in others, they do so in mature organs?

It is mainly due to mobility of minerals. Based on this, they are classified into

1. Actively mobile minerals
2. Relatively immobile minerals

1. **Actively mobile minerals :**
   Nitrogen, Phosphorus, Potassium, Magnesium, Chlorine, Sodium, Zinc and molybdenum. Deficiency symptoms first appear on old and senescent leaves due to active movement of minerals to younger leaves.
2. **Relatively immobile minerals :**
   Calcium, sulphur, iron, boron and copper shows deficiency symptoms first that appear on young leaves due to the immobile nature of minerals.

8. Plant A in a nutrient medium shows whiptail disease plant B in a nutrient medium shows a little leaf disease. Identify mineral deficiency of plant A and B?

Whiptail disease is due to deficiency of Molybdenum. Little leaf disease is due to deficiency of zinc.

9. Write the role of nitrogenase enzyme in nitrogen fixation?

This cycle consists of following stages:

1. Fixation of atmospheric nitrogen :

Di-nitrogen molecule from the atmosphere progressively gets reduced by addition of a pair of hydrogen atoms.

Triple bond between two nitrogen atoms (N N) are cleaved to produce ammonia nitrogen fixation process requires Nitrogenase enzyme complex, Minerals (Mo, Fe and S), anaerobic condition, ATP, electron and glucose 6 phosphate as H1 donor.

Nitrogenase enzyme is active only in anaerobic condition.

To create this anaerobic condition a pigment known as **leghaemoglobin**is synthesized in the nodules which acts as oxygen scavenger and removes the oxygen.

Nitrogen fixing bacteria in root nodules appears pinkish due to the presence of this leghaemoglobin pigment.

$$N_2 + 8e^- + 8H^+ + 16ATP \longrightarrow 2NH_3^+ + H_2 + 16ADP + 16\,Pi$$

2. Nitrification :

Ammonia (NH31) is converted into Nitrite (NO22) by *Nitrosomonas*bacterium. Nitrite is then converted into Nitrate (NO32) by *Nitrobacter*bacterium. Plants are more adapted to absorb nitrate (NO32) than ammonium ions from the soil.

$$2\,NH_3^+ + 3\,O_2 \xrightarrow{Nitrosomonas} 2\,NO_2^- + 2\,H^+ + 2H_2O$$

$$2\,NO_2^- + O_2 \xrightarrow{Nitrobacter} 2\,NO_3^-$$

3. Nitrate Assimilation :

The process by which nitrate is reduced to ammonia is called **nitrate assimilation** and occurs during nitrogen cycle.

$$NO_3^- \xrightarrow[Mo]{\text{Nitrate reductase}} NO_2^-$$

$$NO_2^- \xrightarrow[Cu,\,Fe]{\text{Nitrite reductase}} NH_3^+$$

4. Ammonification

Decomposition of organic nitrogen (proteins and amino acids) from dead plants and animals into ammonia is called **ammonification**.

Organisim involved in this process are *Bacillus ramosus*and *Bacillus vulgaris*.

5. Denitrification

Nitrates in the soil are converted back into atmospheric nitrogen by a process called **denitrification**.

Bacteria involved in this process are *Pseudomonas*, *Thiobacillus* and *Bacillus subtilis*.

$$\underset{(NO_3^-)}{\text{Nitrate}} \xrightarrow{Pseudomonas} \underset{(N_2)}{\text{Molecular Nitrogen}}$$

10. Explain the insectivorous mode of nutrition in angiosperms?

Plants which are growing in nitrogen deficient areas develop insectivorous habito resolve nitrogen deficiency.

a. ***Nepenthes*** (Pitcher plant):
   Pitcher isa modified leaf and contains digestive enzymes. Rim of the pitcher is providedwith nectar glands and acts as an attractive lid. When insect is trapped, proteolyticenzymes will digest the insect.
b. ***Drosera***(Sundew):
   It consists of longclub shaped tentacles which secretesticky digestive fluid which looks like a sundew.
c. ***Utricularia***(Bladder wort):
   Submergedplant in which leaf is modified into abladder to collect insect in water.
d. ***Dionaea***(Venus fly trap):
   Leaf of thisplant modified into a colourful trap. Twofolds of lamina consist of sensitive trigger hairs and when insects touch the hairs itwill close and traps the insects.

UNIT – V PLANT PHYSIOLOGY (FUNCTIONAL ORGANISATION)

Chapter –13 PHOTOSYNTHESIS

I. Fill ups :

1. **Assertion (A):** Increase in Proton gradient inside lumen responsible for ATP synthesis
Reason (R): Oxygen evolving complex of PS I located on thylakoid membrane facing Stroma, releases H1 ions
Assertion is true an reason is false
2. Which chlorophyll molecule does not have a phytol tail? **Chl-c**
3. The correct sequence of flow of electrons in the light reaction is **PS-II, plastoquinone, cytochrome, PS-I, ferredoxin**
4. For every Co2 molecule entering the C3 cycle, the number of ATP and NADPH required **3ATP + 2NADPH**
5. Identify true statement regarding light reaction of photosynthesis? **The reaction center of PS II is chlorophyll a with absorption peak at 700 nm.**

II. Answer the following :

6. Two groups (A & B) of bean plants of similar size and same leaf area were placed in identical conditions. Group A was exposed to light of wavelength 400-450nm & Group B to light of wavelength of 500- 550nm. Compare the photosynthetic rate of the 2 groups giving reasons.

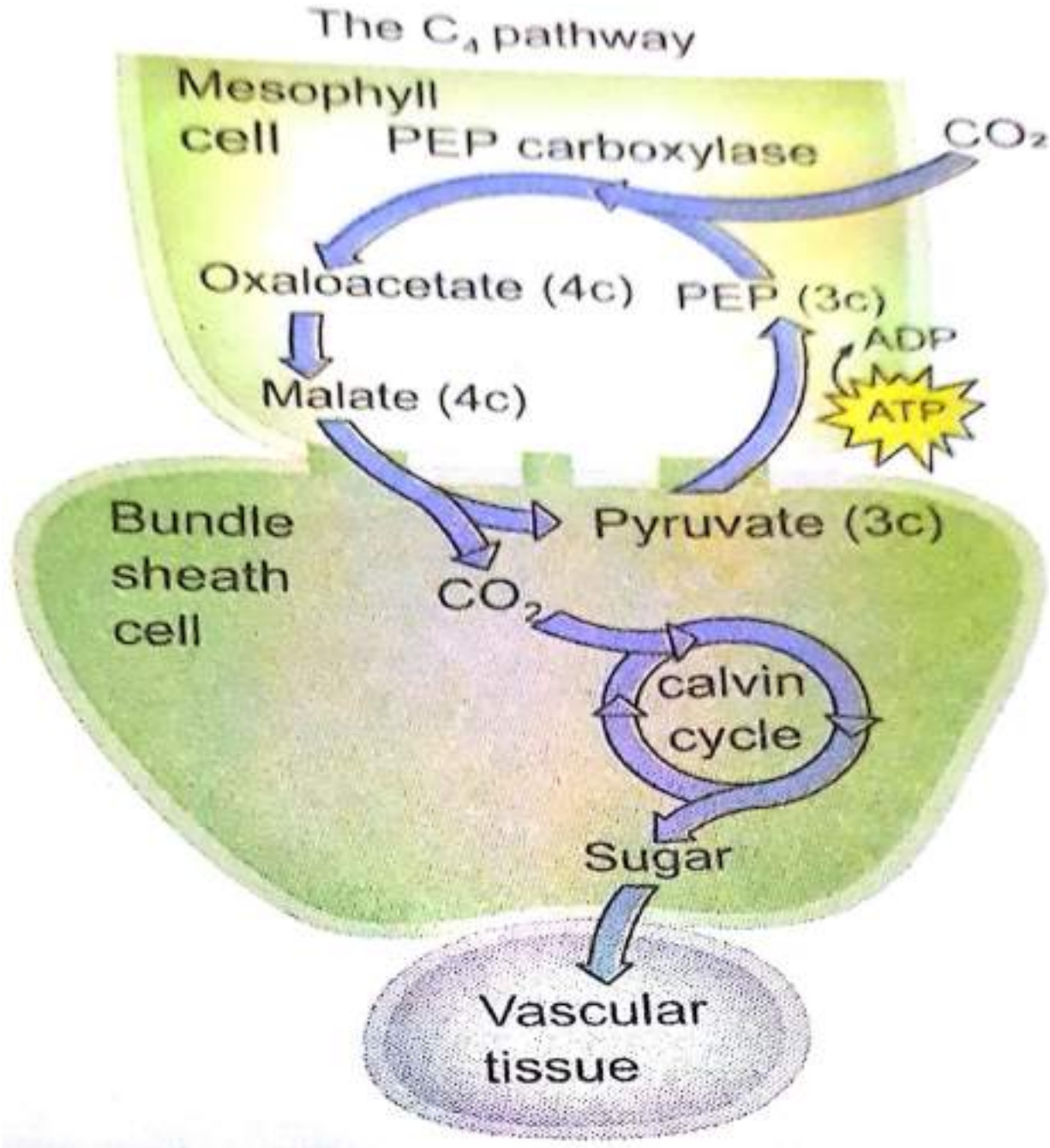
Group A will show more photosynthesis. Chlorophyll absorbs maximum light in the blue region of the spectrum, i.e., 400-500 nm and hence, photosynthetic rate will also he high. Group B will show negligible amount of photosynthesis or no photosynthesis. Chlorophyll does not absorb any light in the green region, i.e., 500-550 nm, but reflects green.

7. A tree is believed to be releasing oxygen during night time. Do you believe the truthfulness of this statement? Justify your answer by giving reasons?

Oxygen is released during light reactions by the splitting of water molecules using the energy obtain from sunlight. Except certain plants performing Crassulacean Acid Metabolism (CAM) all the other plants/trees do not release oxygen during night time. In CAM plants, the stomata are open only during night, at this time they fix Co2 with the help of PEP and produce oxaloacetic acid and release oxygen. Example : Agave, Kalanchoe and Opuntia.s

8. Grasses have an adaptive mechanism to compensate photorespiratory losses- Name and describe the mechanism.

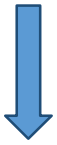
Dicarboxylic acid pathway is an adaptive mechanism in grasses to compensate potorespiratory loss. C_4 pathway is completed in two phases, first phase takes place in stroma ofmesophyll cells, where the CO_2 acceptormolecule is 3-Carbon compound, phosphorenol pyruvate (PEP) to form 4-carbon Oxaloacetic acid (OAA). The first product is a4-carbon and so it is named as C_4 cycle. Oxaloacetic acid is a dicarboxylic acid and hencethis cycle is also known as **dicarboxylicacid pathway**. Carbondioxide fixation takes place in two placesone in mesophyll and another in bundlesheath cell (dicarboxylation pathway). It isthe adaptation of tropical and sub tropicalplants growing in warm and dry conditions.Fixation of CO_2 with minimal loss is dueto absence of photorespiration. C_4 plantsrequire 5 ATP and 2 NADPH 1 H_1 to fixone molecule of CO_2.



Stage: I Mesophyll Cells :

Phosphoenol Pyruvate 1 CO_2

(PEP) (3C)



Oxaloacetic acid (OAA) (4C)
PEP carboxylase

Oxaloacetic acid (OAA) is converted into malic acid or aspartic acid and is transported to the bundle sheath cells through plasmodesmata.

Stage: II Bundle Sheath Cells :

Malic acid undergoes decarboxylation and produces a 3 carbon compound Pyruvic acid and CO_2. The released CO_2 combines with RUBP and follows the calvin cycle and finally sugar is released to the phloem. Pyruvic acid is transported to the mesophyll cells.

9. In Botany class, teacher explains, Synthesis of one glucose requires 30 ATPs in C4 plants and only 18 ATPs in C3plants. The same teacher explains C4 plants are more advantageous than C3 plants. Can you identify the reason for this contradiction?

C4 plants account for about 30% of terrestrial carbon fixation. Increasing the proportion of C4 plants on earth could assist biosequestration of CO2 and represent an important climate change avoidance strategy.

10. When there is plenty of light and higher concentration of O2, what kind of pathway does the plant undergo?Analyse the reasons.

Photorespiration is the excess respiration taking place in photosynthetic cells due to absence of CO2 and increase of O2.

This condition changes the carboxylase role of RUBISCO into oxygenase.

C2 Cycle takes place in chloroplast, mitochondria.

RUBP is converted into PGA and a 2C-compound phosphoglycolate by Rubisco enzyme in chloroplast. Since the first product is a 2C-compound, this cycle is known as **C2 Cycle**.

Phosphoglycolateby loss of phosphate becomes glycolate.
Glycolate formed in chloroplast enters into peroxisome to form glyoxylate and hydrogen peroxide.

Glyoxylate is converted into glycine and transferred into mitochondria.

In mitochondria, two molecules of glycine combine to form serine. Serine enters into
peroxisome to form hydroxy pyruvate.

Hydroxy pyruvate with help of NADH 1 H1becomes glyceric acid. Glyceric acid is cycled back to chloroplast utilising ATP and becomesPhosphoglyceric acid (PGA) and enters into the Calvin cycle (PCR cycle).

Photorespiration does not yield any free energy in the form of ATP.

Under certainconditions 50% of the photosyntheticpotential is lost because of Photorespiration.

Significance of photorespiration :

1. Glycine and Serine synthesised during this process are precursors of many biomolecules like chlorophyll, proteins,nucleotides.
2. It consumes excess NADH 1 H1 generated.
3. Glycolate protects cells from Photo oxidation.

UNIT – V PLANT PHYSIOLOGY (FUNCTIONAL ORGANISATION)

Chapter –14 RESPIRATION

I. Fill ups :

1. The number of ATP molecules formed by complete oxidation of one molecule of pyruvic acid is**15**
2. During oxidation of two molecules of cytosolic NADH+ H+, number of ATP molecules produced in plants are**3**
3. The compound which links glycolysis and Krebs cycle is **acetyl CoA**
4. Assertion (A) : oxidative phosphorylation takes place during the electron transport chain in mitochondria.
   Reason (R) :succinyl CoA is phosophorylated into succinic acid by substrate phosphorylation.
   A and R is correct but R is not the the correct explanation of A
5. Which of the following reaction is not involved in Krebs cycle **splitting of Fructose 1,6 bisphosphate of into two molecules 3C compounds**

II. Answer the following :

1. **What are the enzymes involved in phosphorylation and dephosphorylation reaction in EMP pathway ?**

   In EMP pathway, enzymes involved in phosphorylation are (a) Hexokinase and (b) phosphofructokinase. Enzymes involved in dephosphorylation are (a) pjosphoglycerate kinase and (b) pyruvate kinase**.**

2. **Respiratory quotient is zero in succulent plants. Why?**

In some plants succulent plant like Opuntia, Bryophyllum carbohydrates are partially oxidized to organic acid, particularly malic acid without corresponding release of CO2 but O2 is consumed hence the RQ value will be zero.

$2C_6H_{12}O_6 + 3O_2 \longrightarrow 3C_4H_6O_5 + 3H_2O + \text{Energy}$

$$\text{RQ of glucose in succulents} = \frac{\text{zero molecule of } CO_2}{\text{3 molecules of } O_2}$$
$$= 0 \text{ (zero)}$$

3. Explain the reactions taking place in mitochondrial inner membrane?

In mitochondria, the inner membrane is folded in the form of finger projections towards the matrix called cristae. In cristae many oxysomes (F1 particles) are present which have electron transport carriers are present. According to **Peter Mitchell's Chemiosmotic theory** this electron transport is coupled to ATP synthesis. Electron and hydrogen(proton) transport takes place across four multiprotein complexes(I-IV). They are

1. Complex – I (NADH dehydrogense):

It contains a flavoprotein(FMN) and associated with non-heme iron Sulphur protein (Fe-S). This complex is responsible for passing electrons and protons from mitochondrial NADH (**Internal)** to Ubiquinone(UQ).

$$NADH + H^+ + UQ \rightleftharpoons NAD^+ + UQH_2$$

In plants, an additional NADHdehydrogenase (**External)** complex is present on the outer surface of inner membrane of mitochondria which can oxidise cytosolic NADH 1 H1. Ubiquinone (UQ) or Coenzyme Quinone(Co Q) is a small, lipid soluble electron, proton carrier located within the inner membrane of mitochondria.

2. Complex-II (Succinic dehydrogenase) :

It contains FAD flavoprotein is associatedwith non-heme iron Sulphur (Fe-S) protein. This complex receives electrons and protons from succinate in Krebs cycle and is converted into fumarate and passes to ubiquinone.

$$Succinate + UQ \rightarrow Fumarate + UQH_2$$

3. Complex-III (Cytochrome bc_1 complex) :

This complex oxidises reduced ubiquinone (ubiquinol) and transfers the electrons through Cytochrome bc_1 Complex (Iron Sulphur center bc_1 complex) to cytochrome c. Cytochrome c is a small protein attached to the outer surface of inner membrane and act as a mobile carrier to transfer electrons between complex III to complex IV.

$$UQH_2 + 2Cyt\ c_{oxidised} \rightleftharpoons UQ + 2Cyt\ c_{reduced} + 2H^+$$

4. Complex IV (Cytochrome c oxidase) :

This complex contains two copper centers (A and B) and cytochromes a and a_3. Complex IV is the terminal oxidase andbrings about the reduction of 1/2 O_2 toH_2O.Two protons are needed to form amolecule of H_2O (terminal oxidation).

$$2Cyt\ c_{oxidised} + 2H^+ + 1/2\ O_2 \rightleftharpoons 2Cyt\ c_{reduced} + H_2O$$

The transfer of electrons from reduced coenzyme NADH to oxygen *via* complexes I to IV is coupled to the synthesis of ATP from ADP and inorganic phosphate (Pi) which is called **Oxidative phosphorylation**. The F_0F_1-ATP synthase(also called complex V) consists of $F_0$and F_1. F_1 converts ADP and Pi to ATPand is attached to the matrix side of theinner membrane. F_0 is present in innermembrane and acts as a channel throughwhich protons come into matrix.

4. **What is the name of alternate way of glucose breakdown ?explain the process involved in it?**

During respiration breakdown of glucose in cytosol occurs both by glycolysis (about 2/3) as well as by oxidative pentose phosphate pathway (about 1/3). Pentose phosphate pathway was described by **Warburg**, **Dickens** and **Lipmann** (1938).

Hence, it is also called **Warburg-Dickens-Lipmann pathway**. It takes place incytoplasm of mature plant cells. It is analternate way for breakdown of glucose**.** It is also known as **Hexose monophosphate shunt (HMP Shunt)** or **Direct Oxidative Pathway**. It consists of two phases, oxidative phase and nonoxidative phase. The oxidative events convert six molecules of six carbon Glucose-6-phosphate to 6 molecules of five carbon sugar Ribulose- 5 phosphate with loss of $6CO_2$ molecules and generation of 12 NADPH 1 H1(not NADH). The remaining reactions known as **non-oxidative pathway**, convert Ribulose-5-phosphate molecules to various intermediates such as Ribose-5-phosphate(5C), Xylulose-5- phosphate(5C), Glyceraldehyde-3-phosphate(3C), Sedoheptulose-7-Phosphate(7C), and Erythrose-4-phosphate(4C). Finally, five molecules of glucose-6-phosphate is regenerated.

The overall reaction is:

6 x Glucose-6-Phosphate + 12NADP1+**6H2O**

5 x Glucose-6-Phosphate +6CO2 1 **Pi** +**12NADPH** + **12H**1

The net result of complete oxidationof one glucose-6-phosphate yield 6CO2 and 12NADPH 1 H1. The oxidative pentose phosphate pathway is controlled by glucose-6-phosphate dehydrogenase enzyme which is inhibited by high ratio of NADPH to NADP1.

5. **How will you calculate net products of one sucrose molecule upon complete oxidation during aerobic respiration as per recent view?**

a) Sucrose is a disaccharide composed of one glucose molecule and one fructose molecule.
b) Glucose and fructose are isomers.
c) One glucose molecule on complete oxidation during aerobic respiration yields 38 ATP's. therefore one sucrose molecule is capable to yield double the number of ATP's, approximately 76 ATP's on complete oxidation.

Net products gained on complete oxidation of one sucrose molecule during aerobic respiration:

S. No.	**Stages**	**ATP**	**Reduced NAD+**	**Reduced FAD+**	**Total ATP production**	**CO2 produced**
1.	Glycolysis	4	4	0	16	0
2.	Pyruvic oxidation	0	4	0	12	4
3.	TCA cycle	4	12	4	48	8
	Total	**8**	**60**	**8**	**76**	**12**

UNIT – V PLANT PHYSIOLOGY (FUNCTIONAL ORGANISATION)

Chapter –15 PLANT GROWTH AND DEVELOPMENT

I. Fill ups :

1. Select the wrong statement from the following :
In maturation phase, the cell grow further
2. If the diameter of the pulley is 6 inches, length of pointer is 10 inches and distance travelled by pointer is 5 inches. Calculate the actual growth in length of plant.**30 inches**
3. **ABA** is the powerful growth inhibitor
4. Select the correctly matched one:
   a) Human urine - **auxin A**
   b) Corn gram oil - **auxin B**
   c) Fungus - **GA3**
   d) Herring fish sperm - **kinetin**
   e) Unripe maize grains - **zeatin**
   f) Young cotton bolls - **abscisic acid II**
5. Seed dormancy allows the plants to**prevent deterioration of seed**
6. Which one of the following method are used to break the seed dormancy? **All the above (scarification, stratification, impaction)**

II. Answer the following :

1. Write the physiological effects of cytokinins?

Physiological effect :

• Cytokinin promotes cell division in thepresence of auxin (IAA).

• Induces cell enlargement associate with IAA and gibberellins

• Cytokinin can break the dormancyof certain light-sensitive seeds like tobacco and induces seed germination.

• Cytokinin promotes the growth of lateralbud in the presence of apical bud.

• Application of cytokinin delays the process of aging by nutrient mobilization. It is known as **Richmond Lang effect**.

• Cytokinin (i) increases rate proteinsynthesis (ii) induces the formation of inter-fascicular cambium (iii) overcomes apical dominance (iv) induces formation of new leaves, chloroplast and lateral shoots.

• Plants accumulate solutes very activelywith the help of cytokinins.

2. Describe the mechanism of photoperiodic induction of flowering ?

An appropriate photoperiod in 24 hours' cycle constitutes one inductive cycle.

Plants may require one or more inductive cycles for flowering.

The phenomenon of conversion of leaf primordia into flower primordia under the influence of suitable inductive cycles is called **photoperiodicinduction**. Example: *Xanthium* (SDP) – 1 inductive cycle and *Plantago*(LDP) – 25 inductive cycles.

3. Give a brief account on Programmed Cell Death (PCD)

Senescence is controlled by plants own genetic programme and death of the plant or plant part consequent to senescence is called **Programmed Cell Death**. In short senescence of an individual cell is called **PCD**.

The proteolytic enzymes involving PCD in plants are **phytaspases**and in animals are **caspases**. The nutrients and other substrates from senescing cells and tissues are remobilized and reallocated to other parts of the plant that survives.

The protoplasts of developing xylem vessels and tracheids die and disappear at maturity to make them functionally efficient to conduct water for transport. In aquatic plants, aerenchyma is normally formed in different parts of the plant such as roots and stems which encloses large air spaces that are created through PCD.

In the development of unisexual flowers, maleand female flowers are present in earlier stages, but only one of these two completes its development while other aborts through PCD