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BIO-BOTANY

&

BOTANY

(SHORT VERSION AND LONG VERSION)

11th Standard

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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Bio-Botany & Botany** guide for **11th Standard**. It is prepared as per the latest Syllabus. A deep understanding of the text and exercises is rudimentary to have an insight into the subject. The students have to carefully understand the topics and exercises.

Our guide encompasses all the requirements of the students to comprehend the text and the evaluation of the textbook.

It will be a teaching companion to teachers and a learning companion to students.

Our guide provides a precise and clear understanding of text and exercises from the examination perspective.

In order to learn effectively, I advise students to learn the subject sectionwise and practice the exercises given.

Though these salient features are available in our guide, I cannot negate the indispensable role of the teachers in assisting the student to understand the subject thoroughly.

I sincerely believe this guide satisfies the needs of the students and bolsters the teaching methodologies of the teachers.

I pray the almighty to bless the students for consummate success in their examinations.

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2022-23 பதிப்பு

புதிய பாடப்புத்தகத்தின்படி தயாரிக்கப்பட்டுள்ளது.

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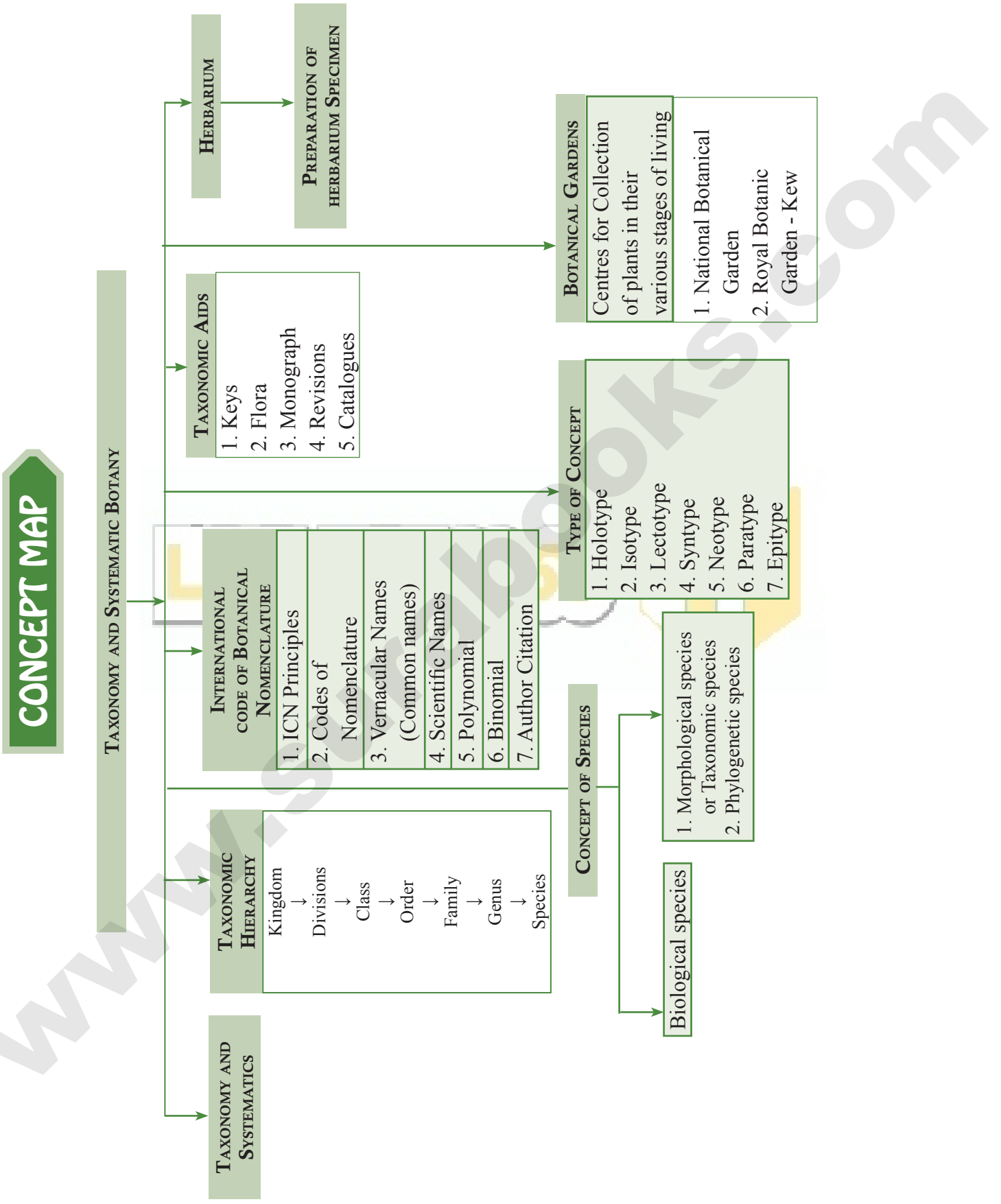
UNIT-II

PLANT MORPHOLOGY AND TAXONOMY OF ANGIOSPERM

Chapter 5

TAXONOMY AND SYSTEMATIC BOTANY

CHAPTER SNAPSHOT



MUST KNOW DEFINITIONS

Taxonomy	:	Taxonomy as "the science dealing with the study of classification including the principles, rules and procedures".
Systematics	:	Systematics as "Scientific study of the kinds and diversity of organisms and all relationships between them".
Taxonomic hierarchy	:	It is the arrangement of various taxonomic levels in descending order starting from kingdom up to species.
Kingdom	:	Kingdom is the highest level or rank of the Taxonomic hierarchy.
Division	:	It is the next level of classification after 'kingdom' that consists of number of classes.
Class	:	It consists of group of orders which share few similarities.
Order	:	It includes group of families which show less similarities among them.
Family	:	It comprises a number of genera which share some similarities among themselves.
Genus	:	It consists of multiple species which have similar characters but differ from the species of another genus.
Species	:	It is the lowest rank of classification and shows the highest level of similarities among the organisms. Species is the fundamental unit of taxonomic classification.
Morphological species (Taxonomic species)	:	When the individuals are similar to one another in one or more features and different from other such groups are called **Morphological speices.**
Biological species (Isolation Species)	:	These are groups of populations that inter breed and are reproductively isolated from other such groups in nature.
Phylogenetic species	:	Phylogenetic species as an evolutionary species is a single lineage of ancestor descendent populations which maintains its such linages identity from other such lineages.
Nomenclature	:	Assigning name for a plant is known as **Nomenclature.**
Vernacular names (Common names)	:	They are very often descriptive and poetic references to plants. It refers to more than one plant or many plants may have same common name.
Scientific names	:	ICN assigns a name for individual plant group which is known as scientific name.
Polynomial	:	Polynomial included a single word for a plant followed by a lengthy list of discriptive terms in Latin. It was followed earlier but now-a-days only binomial is universally followed.
Binomial	:	Scientific name of a species consists of two words. According to **Binomial nomenclature,** the first name is called genus and second one is scientific **Epithet.** Eg: ***Mangifera india.*** ***Mangifera*** is a **genus** name and ***indica*** is specific epithet.
Author Citation	:	This refers to valid name of the taxa accompanied by the author's name who published the name validly. Eg: ***Solanum americanum.L*** **(L stands for Linnaeus)**
Type concept	:	Specimen must be associated with the scientific name known as **Nomenclatural type.** This is either a specimen or may be an illustration.
Taxonomic Aids	:	Taxonomic aids are the tools for the taxonomic study.
Keys	:	Taxonomic keys are the tools for the identification of unfamiliar plants.
Dichotomous type	:	The most common type of key.

Evaluation

1. Phylogenetic classification is the most favoured classification because it reflects
(a) Comparative Anatomy
(b) Number of flowers produced
(c) Comparative cytology
(d) Evolutionary relationships
[Ans. (d) Evolutionary relationships]

2. The taxonomy which involves the similarities and dissimilarities among the immune system of different taxa is termed as *[Sep-2021]*
(a) Chemotaxonomy
(b) Molecular systematics
(c) Serotaxonomy
(d) Numerical taxonomy **[Ans. (c) Serotaxonomy]**

3. Which of the following is a flowering plant with nodules containing filamentous nitrogen fixing micro - organisms?
(a) *Crotalaria juncea*
(b) *Cycas revoluta*
(c) *Cicer arietinum*
(d) *Casuarina equisetifolia*
[Ans. (d) *Casuarina equisetifolia*]

4. Flowers are zygomorphic in
(a) *Ceropegia* (b) *Thevetia*
(c) *Datura* (d) *Solanum*
[Ans. (a) *Ceropegia*]

5. What is the role of national gardens in conserving biodiversity? – Discuss. *[QY-2018 ; Sep-2020]*

Ans. **Role of Botanical Garden:**
1. Gardens with aesthetic value which attract a large number of visitors. Eg: The Great Banyan Tree (*Ficus bengalensis*) in **the Indian Botanical Garden at Kolkata**.
2. Gardens have a wide range of species and supply taxonomic material for botanical research.
3. Garden is used for self-instruction or demonstration purposes.
4. It can integrate information of diverse fields like Anatomy, Embryology, Phytochemistry, Cytology, Physiology and Ecology.
5. Act as a conservation centre for diversity, rare and endangered species.
6. It offers annual list of available species and a free exchange of seeds.
7. Botanical garden gives information about method of propagation, sale of plant material to the general public.

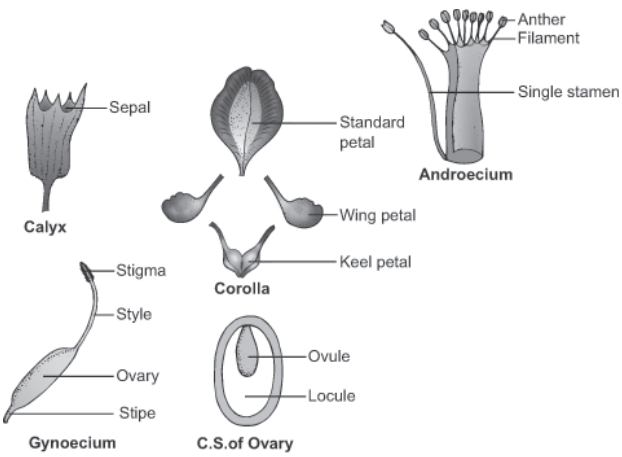
6. Where will you place the plants which contain two cotyledons with cup shaped thalamus?

Ans.

Characteristic		
Class	:	Dicotyledonae (Dicots with two cotyledons)
Sub class	:	Polypetalae (Free petals)
Series	:	Calyciflorae (cup shaped thalamus)

7. Give the floral characters of *Clitoria ternatea*. *[QY-2019 ; Mar-2020; Sep-2021]*

Ans. **Floral characters of *Clitoria ternatea* :**
1. **Inflorescence:** Solitary and axillary.
2. **Flower:** Bracteate, bracteolate, bracteoles usually large, pedicellate, heterochlamydeous, complete, bisexual, pentamerous, zygomorphic and hypogynous.
3. **Calyx:** Sepals 5, synsepalous, green showing valvate aestivation. Odd sepal is anterior in position.
4. **Corolla:** Petals 5, white or blue apopetalous, irregular papilionaceous corolla showing, descendingly imbricate aestivation.



5. **Androecium:** Stamens 10, diadelphous (9) + 1 nine stamens fused to form a bundle and the tenth stamen is free. Anthers are dithecous, basifixed, introse and dechiscing by longitudinal slits.

6. **Gynoecium:** Monocarpellary, unilocular, with many ovules on mariginal placentation, ovary superior, style simple and incurved with feathery stigma.
7. **Fruit:** Legume

8. How will you distinguish Solanaceae members from Liliaceae members?

Ans.

No.	General Characters	Family Solanaceae	Liliaceae
1.	Habit	Mostly annual herbs, shrubs, small trees.	Mostly perennial herbs.
2.	Root	Branched tap root system.	Adventitious and fibrous, typically contractile.
3.	Stem	Herbaceous or woody tuberous at times.	Bulbous, Rhizomes, Cladodes and phylloclades seen.
4.	Leaf	Alternate, simple, rarely compound, unicostate reticulate venation.	Radical or Cauline, alternate, opposite, parallel venation.
5.	Inflorescence	Generally axillary or terminal cymose.	Simple or Branched racemes.
6.	Flower	Pentamerous, actinomorphic or weakly zygomorphic due to oblique position of the ovary.	Showy and actinomorphic, trimerous, slightly zygomorphic.
7.	Calyx	5 Sepals, synsepalous valvate aestivation persistent.	Perianth 6, tepals in 2 whorls of 3 each apotepalous valvate or imbricate.
8.	Corolla	5 petals, sympetalous different shapes of corolla tube, valvate.	Absent
9.	Androecium	Stamens 5, Epipetalous dithecous anthers, longitudinal, porous dehiscence.	6 stamens is two whorls of 3 each dithecous anthers, vertical dehiscence/ porous.
10.	Gynoecium	Bicarpellary, syncarpous, obliquely placed ovary. Tetralocular due to false septa, axile placentation.	Tricarpellary, syncarpous, trilocular with ovules on axile placentation. Nectar secreting glands present in the ovary.
11.	Fruit	Capsule / Berry.	Septicidal or loculicidal capsule or berry.

GOVERNMENT EXAM QUESTIONS

Bio-Botany (Short version)

Choose the Correct Answers — 1 MARK

1. Statement *[Govt. MQP-2018]*

(i) Taxonomy governs the practices of the classification and naming
(ii) Systematics governs the practices of classification, naming and preservation

(a) Both (i) and (ii) are correct
(b) (i) is correct and (ii) is wrong
(c) (i) is wrong and (ii) is correct
(d) Both (i) and (ii) are wrong

[Ans. (b) (i) is correct and (ii) is wrong]

2. Artificial system of classification is also known as _____ of classification. *[QY-2018]*

(a) Natural system (b) Phylogenetic system
(c) Bio-systematic (d) Sexual system

[Ans. (d) Sexual system]

3. _____ is known as Father of Botany. *[Sep-2021]*

(a) John Ray (b) Theophrastus
(c) Bauhin (d) Linnaeus

[Ans. (b) Theophrastus]

Very Short Answers — 2 MARKS

1. Find out the floral formula for a unisexual female flower with bract and without bracteolate trimerous with indisinct calyx and corolla with Trilocular superior ovary. *[QY-2019]*

Ans. Br., Ebrl., ⊕, ♀, $P_{(3+3)}$, A_0 $\underline{G}_{(3)}$.

2. What is Biosystematics? *[HY-2018]*

Ans. 1. Biosystematics is an "Experimental, ecological and cytotaxonomy" through which life forms are studied and their relationships are defined.

2. The term biosystematics was introduced by **Camp & Gilly** in 1943.

Short Answers — 3 MARKS

1. Write the major class of seed plants. *[QY-2018]*

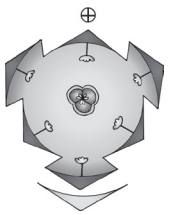
Ans. **Phanerorgams :** Seed producing plants. They are **Gymnosperms :** They are naked seed producing plants. **Eg:** a) Cycas, b) Thuja c) Taxus, d) Ginkgo. **Angiosperms :** Seeds are enclosed by fruit which is formed by ovary. **Eg:** *Mangifera indica*, *Musa*

2. Draw the floral diagram and write the floral formula of Allium cepa. *[HY-2019]*

Ans. **Floral Formula:**

Br., Ebrl., ⊕, ♀, $P_{(3+3)}$, A_{3+3}, $\underline{G}_{(3)}$.

Floral diagram :



3. How does molecular markers work to unlock the evolutionary history of organisms?

Ans. 1. Molecular Taxonomy is the branch of phylogeny that analyses hereditary molecular differences, mainly in DNA sequences, to gain information and to establish genetic relationship between the members of different taxonomic categories.

2. Different molecular markers like allozymes, mitochondrial DNA, micro satellites, RFLP (Restriction Fragment Length Polymorphism), RAPD (Random amplified polymorphic DNA), AFLPs (Amplified Fragment Length Polymorphism), single nucleotide polymorphism- SNP, microchips or arrays are used in analysis.

(a) RFLP (Restriction Fragment Length Polymorphism): *[Sep-2020]*

RFLPs is a molecular method of genetic analysis that allows identification of taxa based on unique patterns of restriction sites in specific regions of DNA.

(b) Amplified Fragment Length Polymorphism (AFLP): *[Sep-2020]*

A restriction enzyme is used to cut DNA into numerous smaller pieces, each of which terminates in a characteristic nucleotide sequence.

AFLP is largely used for population genetics studies, studies of closely related species etc.,

(c) Random Amplified Polymorphic DNA (RAPD): *[Sep-2020]*

(i) It is a method to identify genetic markers using a randomly synthesized primer that will anneal (recombine (DNA) in the double stranded form) to complementary regions located in various locations of isolated DNA.

(ii) If another complementary site is present on the opposing DNA strand at a distance that is not too great (within the limits of PCR) then the reaction will amplify this region of DNA.

(iii) RAPDs like microsatellites may often be successfully employed in phylogenetic studies to address relationships within a species or between closely related species.

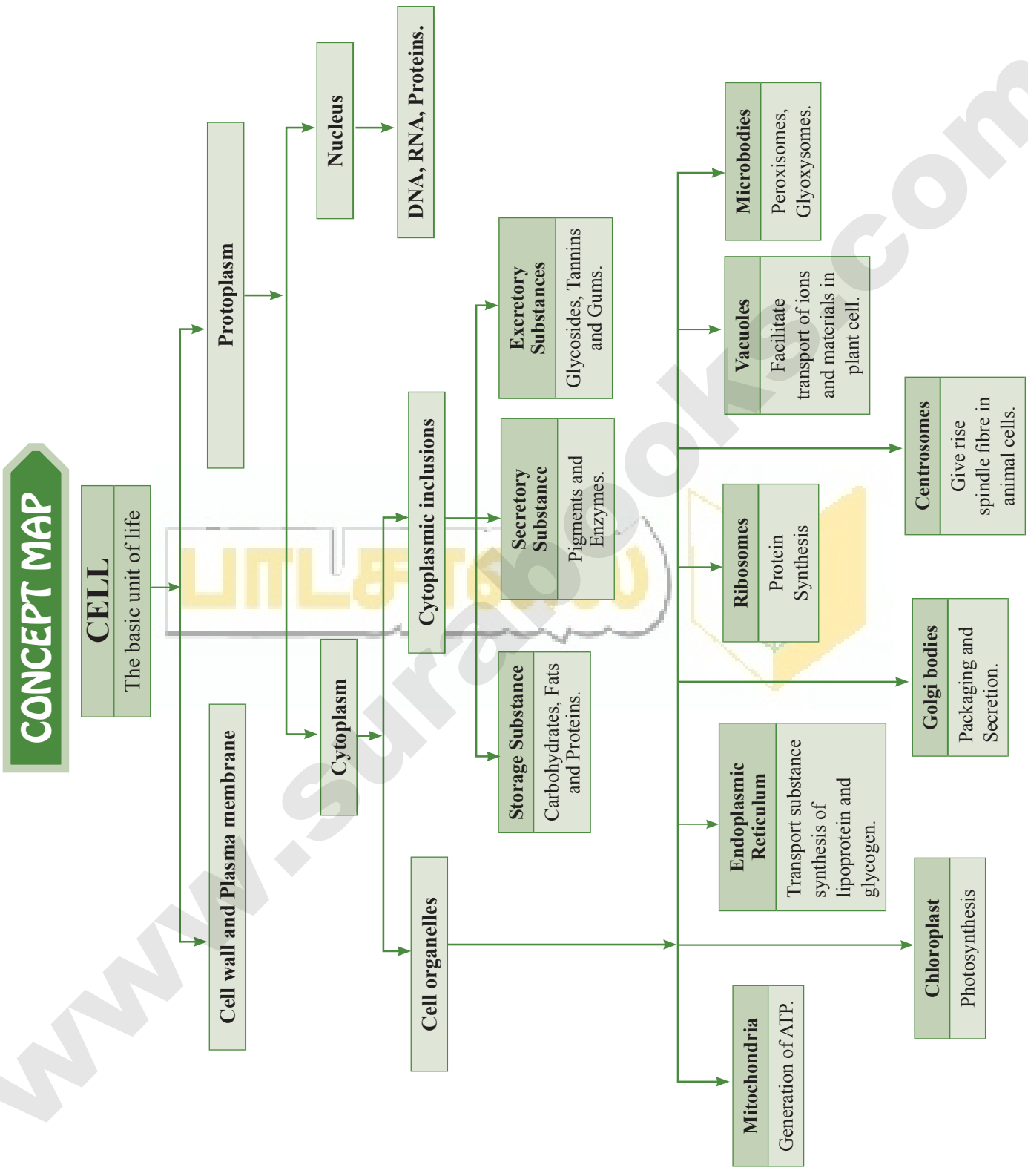
UNIT-III

CELL BIOLOGY AND BIOMOLECULES

Chapter 6

CELL: THE UNIT OF LIFE

CHAPTER SNAPSHOT



MUST KNOW DEFINITIONS

Magnification	:	The optical increase in the size of an image is called **Magnification.**
Compound Microscope	:	The common light microscope which has many lenses are called as **Compound microscope.**
Primary magnification	:	The first magnification of the microscope is done by the objective lens which is called **Primary magnification.**
Secondary magnification.	:	The second magnification of the microscope is obtained through eye piece lens and called as **Secondary magnification.**
'Patch Stop Carrier'	:	A special effect in an ordinary microscope is brought about by means of a special component called 'Patch Stop Carrier'.
Micrometry	:	The microscope also has facility to measure microscopic objects through a technique called **'Micrometry'.**
Prokaryotes	:	The organisms with primitive nucleus are called as **Prokaryotes.**
Mesokaryotes	:	The organisms which shares some of the characters of both prokaryotes and eukaryotes.
Eukaryotes	:	Those organisms which have true nuclues are called as **Eukaryotes.**
Protoplasm	:	It is the living content of the cell that is surrounded by plasma membrane.
Cell Wall	:	It is the outermost protective cover of a cell.
Flip flopping or Flip flop movement	:	The movement of membrane lipids from one side of the membrane to the other side by vertical movement is called flip flopping or flip flop movement.
Cytoplasmic streaming	:	Movement of the cellular materials around the cell occurs through a process called **Cytoplasmic streaming.**
Endoplasmic Reticulum (ER)	:	It is the largest of the internal membranes of a plant cell.
Rough Endoplasmic Reticulum (RER)	:	Ribosomes are present in the outer surface of the membrane it is called as **RER.**
Smooth Endoplasmic Reticulum (SER)	:	Ribosomes are absent in the endoplasmic reticulum it is called as **SER.**
Thylakoid	:	In chloroplast, inside the stroma there are flat interconnected sacs called **Thylakoid.**
Quantosomes	:	Thylakoid contain small, rounded photosynthetic units called **Quantosomes.**
Polysomes or Polyribosomes	:	During protein synthesis many ribosomes are attached to the single mRNA and is called **Polysomes or Polyribosomes.**
Microbodies	:	Eukaryotic cells contain enzyme bearing membrane enclosed vesicles called **Microbodies**.

Cell inclusions	:	These are non-living materials present in the cytoplasm. They are organic and inorganic compounds.
Chromosome	:	During cell division chromatin is condensed into an organized from called **Chromosome.**
Chromatin	:	The chromosomes are composed of thread like strands called **Chromatin** which is made up of DNA, protein and RNA.

Evaluation

1. The two subunits of ribosomes remain united at critical ion level of

(a) Magnesium (b) Calcium
(c) Sodium (d) Ferrous

[Ans. (a) Magnesium]

2. Sequences of which of the following is used to know the phylogeny *[HY-2019]*

(a) mRNA (b) rRNA
(c) tRNA (d) Hn RNA

[Ans. (b) rRNA]

3. Many cells function properly and divide mitotically even though they do not have *[Mar-2020]*

(a) Plasma membrane (b) cytoskeleton
(c) mitochondria (d) Plastids

[Ans. (d) 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

(a) Neither lipid nor proteins can flip-flop
(b) Both lipid and proteins can flip flop
(c) While lipids can rarely flip-flop proteins cannot
(d) While proteins can flip-flop lipids cannot

[Ans. (c) While lipids can rarely flip-flop proteins cannot]

5. Match the columns and identify the correct option: *[Sep-2020]*

	Column-I		Column-II
(a)	Thylakoids	(i)	Disc-shaped sacs in Golgi apparatus
(b)	Cristae	(ii)	Condensed structure of DNA
(c)	Cisternae	(iii)	Flat membranous sacs in stroma
(d)	Chromatin	(iv)	Infoldings in mitochondria

	(a)	(b)	(c)	(d)
(1)	(iii)	(iv)	(ii)	(i)
(2)	(iv)	(iii)	(i)	(ii)
(3)	(iii)	(iv)	(i)	(ii)
(4)	(iii)	(i)	(iv)	(ii)

[Ans. (3) a-(iii), b-(iv), c-(i), d-(ii)]

6. Bring out the significance of Transmission Electron Microscope.

Ans.
1. It provides two dimensional image.
2. The magnification is 1–3 lakhs times and resolving power is 2–10 Å.
3. It is used for studying detailed structure of viruses, mycoplasma, cellular organelles, etc.

7. State the protoplasm theory. *[Mar-2020]*

Ans.
1. **Max Schultze (1861)** established similarity between protoplasm and sarcode and proposed a theory which later on was called **"Protoplasm Theory"** by **O. Hertwig (1892).**
2. **Huxley (1868)** proposed protoplasm as a "physical basis of life". (Sarcode - Living juice in animal cell.)

8. Distinguish between prokaryotes and eukaryotes. *[QY-2018]*

Ans.

Features	Prokaryotes	Eukaryotes
Size of the cell	~1 - 5 µm	~10 - 100 µm
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

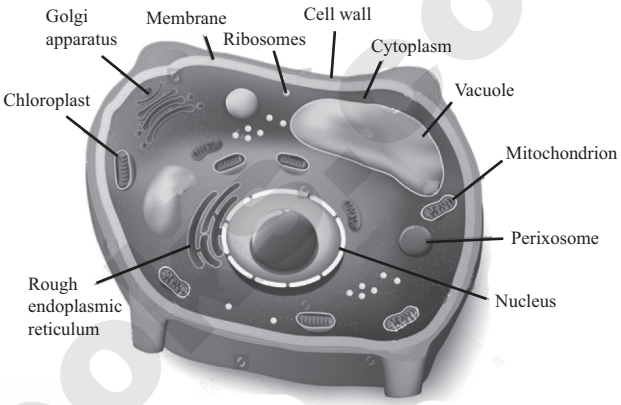
9. Difference between plant and animal cell. *[Mar-2020 ; Sep-2020; Sep-2021]*

Ans.

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.

10. Draw the ultra structure of plant cell. *[Sep-2020]*

Ans.



Ultra Structure of Plant Cell

GOVERNMENT EXAM QUESTIONS

Bio-Botany (Short version)

CHOOSE THE CORRECT ANSWERS 1 MARK

1. Regarding flip-flop movement, which one of the following statement is correct? *[Govt. MQP-2018]*

(a) Proteins can flip-flop, lipids cannot
(b) Neither lipids nor proteins can flip-flop
(c) Both lipids and proteins can flip-flop
(d) Lipdis can rarely flip-flop, proteins cannot

[Ans. (d) Lipdis can rarely flip-flop, proteins cannot]

2. German botanist Matthias Schleiden and German Zoologist Theodor Schwann proposed cell theory in _____ . *[QY-2018]*

(a) 1833 (b) 1883
(c) 1863 (d) 1933 **[Ans. (a) 1833]**

3. Ribosomes were first observed by _____ *[HY-2018]*

(a) Christian de Duve (b) George Palade
(c) A.Kolliker (d) A.F.U.Schimper

[Ans. (d) A.F.U.Schimper]

UNIT-III

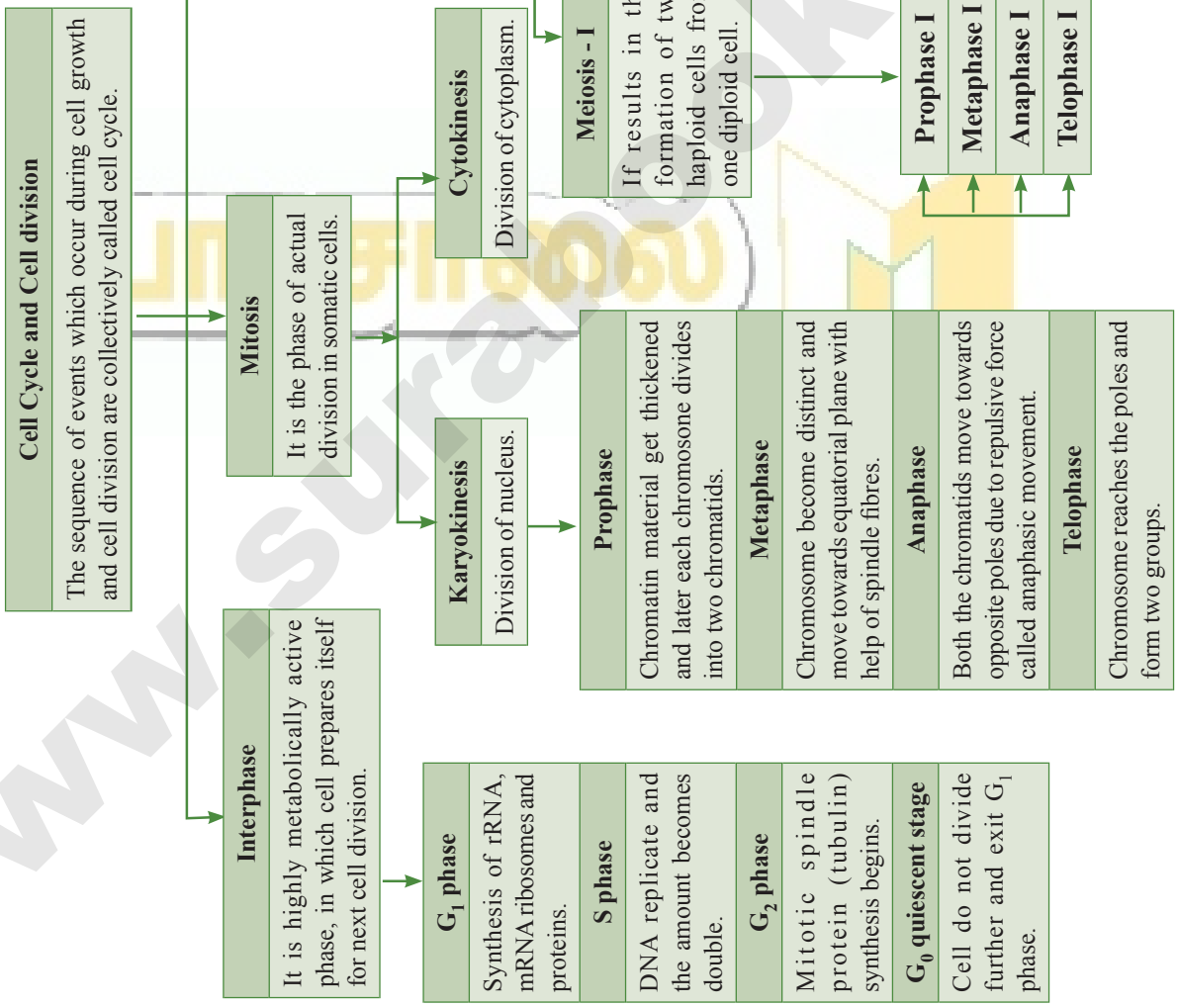
CELL BIOLOGY AND BIOMOLECULES

Chapter 7

CELL CYCLE

CHAPTER SNAPSHOT

CONCEPT MAP



Evaluation

1. **The correct sequence in cell cycle is** *[Mar-2020]*
(a) S-M-G_1-G_2 (b) S-G_1-G_2-M
(c) G_1-S-G_2-M (d) M-G-G_2-S
[Ans. (c) G_1-S-G_2-M]

2. **If mitotic division is restricted in G_1 phase of the cell cycle then the condition is known as**
(a) S Phase (b) G_2 Phase
(c) M Phase (d) G_0 Phase
[Ans. (d) G_0 Phase]

3. **Anaphase promoting complex APC is a protein degradation machinery necessary for proper mitosis of animal cells. If APC is defective in human cell, which of the following is expected to occur?**
(a) Chromosomes will be fragmented
(b) Chromosomes will not condense
(c) Chromosomes will not segregate
(d) Recombination of chromosomes will occur
[Ans. (c) Chromosomes will not segregate]

4. **In S phase of the cell cycle** *[QY-2019]*
(a) Amount of DNA doubles in each cell
(b) Amount of DNA remains same in each cell
(c) Chromosome number is increased
(d) Amount of DNA is reduced to half in each cell
[Ans. (a) Amount of DNA doubles in each cell]

5. **Centromere is required for** *[Sep-2020]*
(a) transcription
(b) crossing over
(c) cytoplasmic cleavage
(d) movement of chromosome towards pole
[Ans. (d) movement of chromosome towards pole]

6. **Synapsis occur between** *[Sep-2021]*
(a) mRNA and ribosomes
(b) spindle fibres and centromeres
(c) two homologous chromosomes
(d) a male and a female gamete
[Ans. (c) two homologous chromosomes]

7. **In meiosis crossing over is initiated at**
(a) Diplotene (b) Pachytene
(c) Leptotene (d) Zygotene
[Ans. (b) Pachytene]

8. **Colchicine prevents the mitosis of the cells at which of the following stage**
(a) Anaphase (b) Metaphase
(c) Prophase (d) interphase
[Ans. (b) Metaphase]

9. **The paring of homologous chromosomes on meiosis is known as** *[QY-2018 & Mar.-2019]*
(a) Bivalent (b) Synapsis
(c) Disjunction (d) Synergids
[Ans. (b) Synapsis]

10. **Write any three significance of mitosis.**
[June-2019 ; Mar:2020]

Ans.
1. **Genetic stability** - Daughter cells are genetically identical to parent cells.
2. **Growth** - As multicellular organisms grow, the number of cells making up their tissue increases. The new cells must be identical to the existing ones.
3. **Repair of tissues** - Damaged cells must be replaced by identical new cells by mitosis.

11. **Differentiate between mitosis and meiosis.**
[Mar-2020 ; Sep-2020]

Ans.

No.	Mitosis	Meiosis
1.	One division.	Two divisions.
2.	Number of chromosome remain 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 pair up to form bivalent.
5.	Chiasmata do not form and crossing over never occurs.	Chiasmata form and crossing over occurs.
6.	Daughter cells are genetically identical.	Daughter cells are genetically different from the parent cells.
7.	Two daughter cells are formed.	Four daughter cells are formed.

12. Give an account of G_0 phase.

Ans.

1. During interphase some cells exit G_1 and enters a quiescent stage called G_0, where the cells remain metabolically active without proliferation.
2. Cells can exist for long periods in G_0 phase. In G_0 cells cease growth with reduced rate of RNA and protein synthesis.
3. G_0 phase is not permanent. Mature neuron and skeletal muscle cell remain permanently in G_0.
4. Many cells in animals remains in G_0 unless called on to proliferate by appropriate growth factors or other extracellular signals.
5. G_0 cells are not dormant.

13. Differentiate cytokinesis in plant cells and animal cells.

Ans.

Cytokinesis in Animal Cells :

1. It is a contractile process.
2. The ring consists of a bundle of microfilaments assembled from **actin** and **myosin.**
3. This fibril helps for the generation of a contractile force.
4. This force draws the contractile ring inward forming a cleavage furrow in the cell surface dividing the cell into two.

Cytokinesis in Plant Cell :

1. 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.
2. Phragmoplast contains microtubules, actin filaments and vesicles from **golgi apparatus** and **ER**.
3. The golgi 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 there becomes new cell wall.
4. The first stage of cell wall construction is a line dividing the newly forming cells called a **cell plate.**
5. The cell plate eventually stretches right across the cell forming the middle lamella. Cellulose builds up on each side of the middle lamella to form the cell walls of two new plant cells.

14. Write about Pachytene and Diplotene of Prophase I.

Ans. It is the third stage of Mieotic prophase I.

Pachytene :

1. At this stage bivalent chromosomes are clearly visible as tetrads. Bivalent of meiosis I consists of 4 chromatids and 2 centromeres.
2. Synapsis is completed and recombination nodules appear at a site where crossing over takes place between non-sister chromatids of homologous chromosome.
3. 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 :

1. Synaptonemal complex disassembled and dissolves. The homologous chromosomes remain attached at one or more points where crossing over has taken place.
2. 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 taken place.
3. They are specialised chromosomal structures that hold the homologous chromosomes together.
4. Sister chromatids remain closely associated whereas the homologous chromosomes tend to separate from each other but are held together by chiasmata.
5. 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.
6. In animals, the chromosomes have prominent loops called **lampbrush chromosome.**

GOVERNMENT EXAM QUESTIONS

Bio-Botany (Short version)

Choose the Correct Answers 1 MARK

1. If the initial amount of DNA is 8 C then after S phase the amount of DNA would be _____. *[Govt. MQP-2016]*

(a) 4 C (b) 8 C (c) 64 C (d) 16 C

[Ans. (d) 16 C]

2. Arrange the stages of meiotic prophase - I in order *[QY-2019]*

(a) Zygotene, Diplotene, Diakinesis, Pachytene, Leptotene
(b) Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis
(c) Leptotene, Pachytene, Zygotene, Diplotene, Diakinesis
(d) Leptotene, Zygotene, Pachytene, Diakinesis, Diplotene

[Ans. (b) Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis]

3. In which cell division, independent assortment of genes takes place? *[Sep-2020]*

(a) Closed mitosis (b) Open mitosis
(c) Amitosis (d) Meiosis

[Ans. (d) Meiosis]

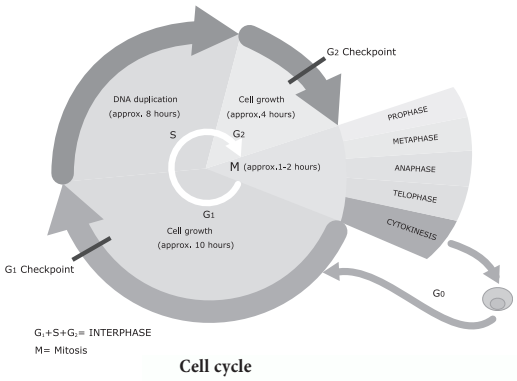
Very Short Answers — 2 MARKS

1. Name the two phases of cell cycle which lasts for longest and shortest span of hours. *[Govt. MQP-2018]*

Ans. Longest span of hours - G_1 phase of inter phase Shortest span of hours - Mitosis.

2. A series of events leading to the formation of new cell is known as Cell Cycle. Give the diagrammatic view of Cell Cycle. *[March-2019]*

Ans.



Cell cycle

3. What is Synapsis? *[HY-2018]*

Ans. **Synapsis :** Pairing of homologous chromosomes takes place and it is known as **synapsis**.

4. Define Cell Cycle. *[HY-2019]*

Ans. A series of events leading to the formation of new cell is known as **cell cycle.**

5. What are chiasmata? State their significance. *[Sep-2021]*

Ans. **Chiasmata:** 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 sides of crossing over is called Chiasmata.

Short Answers — 3 MARKS

1. At the end of a cell division, a cell produces four cells. Identify the type of cell division and mention its significance in evolution. *[Govt. MQP-2019]*

Ans. The cell division is meiosis.

Significance of meiosis :

1. This maintains a definite constant number of Chromosomes in organisms.
2. Crossing over takes place and exchange of genetic material leads to variations among species.
3. These variations are the raw materials to evolution.
4. Meiosis provides genetic variability by partitioning different combinations of genes into gametes through independent assortment.
5. Adaptation of organisms to various environmental stress.

Long Answers — 5 MARKS

1. (i) Why is meiosis essential in sexually reproducing organisms?

(ii) Differentiate between S-phase and G_2-phase. *[QY-2019]*

Ans. **(i)**

1. Meiosis is essential in sexually reproducing organisms because it keeps the chromosome number constant during formation of gametes / spores.
2. This ensures constant number of chromosomes in **parent** and **offsprings**.

(ii)

No.	S-phase	G_2 phase
1.	It is called synthetic phase.	It is called pre-mitotic phase.
2.	Growth of the cell continues as replication of DNA occurs.	Cell growth continues by protein and cell organelle synthesis, mitochondria and chloroplasts divide.
3.	DNA content increases from 2C to 4C.	DNA content remains as 4C.

Botany (Long version)

Choose the Correct Answers — 1 MARK

1. Anastral mitosis is the characteristic feature of . *[Mar-2020]*

(a) All living organisms (b) Lower animals
(c) Higher animals (d) Higher plants

[Ans. (d) Higher plants]

Short Answers — 3 MARKS

1. What is Karyokinesis and Cytokinesis? *[Sep-2021]*

Ans. **Karyokinesis :**

1. Involves division of nucleus.
2. Nucleus develops a constriction at the center and becomes dumbell shaped.
3. Constriction deepens and divides the nucleus into two.

Cytokinesis :

1. Involves division of cytoplasm.
2. Plasma membrane develops a constriction along nuclear constriction.
3. It deepens centripetally and finally divides the cell into two cells.

Example: Cells of mammalian cartilage, macronucleus of Paramecium and old degenerating cells of higher plants.

HOTS

1. Imagine a situation if there was no meiosis. Then what would have happened to the next generation?

Ans. 1. In the absence of meiosis the next generation would have double the number of chromosomes after fusion of gametes.
2. This would have resulted in the birth of an altogether new species or produce abnormal offsprings.
3. The maintenance of characters set would have been possible only through asexual reproduction.

2. Rajan had an accident and he was badly injured. His leg was wounded. Later the damaged skin was replaced by new tissues during healing.

(a) What is the process involved?

(b) Does it happen during normal times in our body.

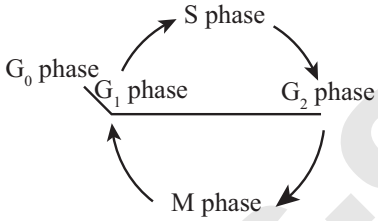
Ans. (a) The process involved is Mitosis. New cells are added and repair of damaged cells occur.

(b) Mitosis takes place at all times in our body. Mitosis helps in growth of multicellular organisms by division and addition of new cells in the body.

3. What do you understand by interphase?

Ans. 1. Longest part of the cell cycle, but it is of extremely variable length.
2. It consists of three phases, G_1, S, G_2 phase which is followed by cell division.

4. Answer the following questions based on the figure.



1. Which is the resting stage?

Ans. G_0 phase

2. Which is the stage where replication takes place?

Ans. S phase

3. Which is the stage where mitosis takes place?

Ans. M phase

4. Which is the pre cell division stage?

Ans. G_2 phase

UNIT-III

CELL BIOLOGY AND BIOMOLECULES

Chapter 8

BIOMOLECULES

CHAPTER SNAPSHOT

MUST KNOW DEFINITIONS

Water	:	Water is the most abundant component in living organisms.
Macromolecules	:	Simple molecules assemble and form large and complex molecules called as **Macromolecules.**
Monosaccharides	:	Monosaccharides are relatively small molecules constituting single sugar unit. Eg: **Glucose.**
Disaccharides	:	They are formed when two monosaccharides join together. Eg: Sucrose.
Polysaccharides	:	These are made of hundreds of monosaccharide units. It is also called 'Glycans'.
Starch	:	Starch is a storage polysaccharides made up of repeated units of **Amylose** and **Amylopectin.**
Glycogen	:	It is also a storage polysaccharide otherwise called as **Animal starch.**
Celluloses	:	Cellulose is a structural polysaccharide made up of thousands of glucose units.
Triglycerides	:	Triglycerides are composed of single molecule of glycerol bound to 3 fatty acids.
Phospholipids	:	A class of lipids that serves as major structural component of cell membrane is **Phospholipids.**
Protein Denaturation	:	Denaturation is the loss 3D structure of protein.
Lock and Key Mechanism	:	The substrate binds to the specially formed pocket in the enzyme, the active site, this is called **Lock and key mechanism of enzyme action.**
Inhibitors	:	Certain substances present in the cells may react with the enzyme and lower the rate of reaction. These substances are called **Inhibitors.**
Competitive Inhibitors	:	Molecules that resembles the shape of the substrate and may compete to occupy the active site of enzyme are known as **Competitive Inhibitors.**
Cofactors	:	Many enzymes require non-protein components called **Cofactors** for their efficient activity.
Nucleotides	:	DNA and RNA are polymers of monomers called **Nucleotides.**
Nucleosides	:	A purine or a pyrimidine and a ribose or deoxyribose sugar is called **Nucleoside.**
Nucleotide	:	When a phosphate group is attached to a nucleoside it is called as **Nucleotide.**
RNA	:	It is a polymeric molecule, single stranded and is unstable when compared to DNA, made up of Ribonucleotides.

Evaluation

1. The most basic amino acid is

(a) Arginine (b) Histidine
(c) Glycine (d) Glutamine

[Ans. (a) Arginine]

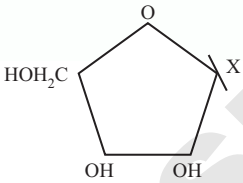
2. An example of feedback inhibition is ***[Sep-2020]***

(a) Cyanide action on cytochrome.
(b) Sulpha drug on folic acid synthesiser bacteria.
(c) Allosteric inhibition of hexokinase by glucose - 6 - phosphate.
(d) The inhibition of succinic dehydrogenase by malonate. **[Ans. (c) Allosteric inhibition of hexokinase by glucose - 6 - phosphate]**

3. Proteins perform many physiological functions. For example some functions as enzymes. One of the following represents an additional function that some proteins discharge :

(a) Antibiotics
(b) Pigment conferring colour to skin
(c) Pigments making colours of flowers
(d) Hormones **[Ans. (d) Hormones]**

4. 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 & one blank component " X" in it.



Category	Compound
Cholesterol	Guanine
Amino acid	NH_2
Nucleotide	Adenine
Nucleoside	Uracil **[Ans. (Nucleoside – Uracil)]**

5. Distinguish between nitrogenous base and a base found in inorganic chemistry.

Ans. **Nitrogenous base:**

The organic compounds which contain elemental nitrogen are called as **nitrogenous bases** and they have the chemical property of a base.

Base found in inorganic chemistry:

Inorganic bases on the other hand do not contain nitrogen but they furnish OH^- ions in solution and accept a proton.

6. Write the characteristic features of DNA.

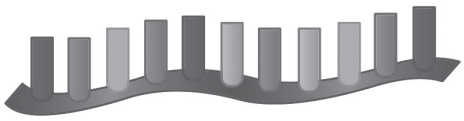
[Mar-2020; Sep-2021]

Ans.

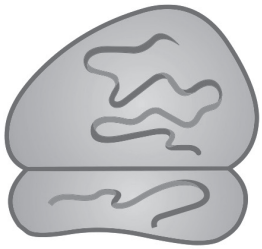
1. If one strand runs in the 5'– 3' direction, the other runs in 3'– 5' direction and thus are antiparallel (they run in opposite direction).The 5' end has the phosphate group and 3'end has the OH group.
2. The angle at which the two sugars protrude from the base pairs is about 120˚, for the narrow angle 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.**
3. Each base is 0.34nm 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.
4. DNA helical structure has a diameter of 20A° and a pitch of about 34A°. X-ray crystal study of DNA takes a stack of about 10 bp to go completely around the helix (360°).
5. The phosphodiester linkages gives an inherent polarity to the DNA helix. They form strong **covalent bonds**, gives the strength and stability to the plolynucleotide chain.
6. **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.
7. Based on the helix and the distance between each turns the DNA is of three forms – **A-DNA, B-DNA** and **Z-DNA.**

7. Explain the structure and function of different types of RNA.

Ans. **Ribonucleic acid (RNA):** Ribonucleic acid (RNA) is a polymeric molecule essential in various biological roles in coding, decoding, regulation and expression of genes. RNA is single stranded and is unstable when compared to DNA.



Messenger RNA (mRNA)



Ribosomal RNA (rRNA)

Transfer RNA (tRNA)

Types of RNA :

1. **mRNA (messenger RNA) –** Single stranded, carries a copy of instructions for assembling amino acids into proteins.
2. It is very unstable and comprises 5% of total RNA polymer.
3. Prokaryotic mRNA (Polycistronic) carry coding sequences for many polypeptides.
4. Eukaryotic mRNA (Monocistronic) contains information for only one polypeptide.
5. **tRNA (transfer RNA)** – Translates the code from mRNA and transfers amino acids to the ribosome to build proteins.
6. It is highly folded into an elaborate 3D structure and comprises about 15% of total RNA.
7. It is also called as soluble RNA.
8. **rRNA (ribosomal RNA)** – Single stranded, metabolically stable, make up the two subunits of ribosomes.
9. It constitutes 80% of the total RNA. It is a polymer with varied length from 120 – 3000 nucleotides and gives ribosomes their shape.
10. Genes for rRNA are highly conserved and employed for phylogenetic studies.

GOVERNMENT EXAM QUESTIONS

Bio-Botany (Short version)

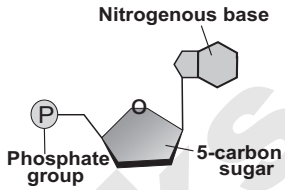
CHOOSE THE CORRECT ANSWERS 1 MARK

1. Which of the following is disaccharide? *[Govt. MQP-2018]*

(a) Sucrose (b) Ribose
(c) Starch (d) Fructose

[Ans. (a) Sucrose]

2. *[March-2019]*



The above structure represents a _____.

(a) Polynucleotide (b) Amino acid
(c) Nucleoside (d) Nucleotide

[Ans. (d) Nucleotide]

3. The structure of Glycine amino acid is: *[June-2019]*

(a) $H_3N^+ - \underset{H}{\overset{COO^-}{\underset{|}{\overset{|}{C-H}}}}$ (b) $H_3N^+ - \underset{CH_3}{\overset{COO^-}{\underset{|}{\overset{|}{C-H}}}}$

(c) $H_3N^+ - \underset{CH_2OH}{\overset{COO^-}{\underset{|}{\overset{|}{C-H}}}}$ (d) $H_3N^+ - \underset{SH}{\overset{COO^-}{\underset{|}{\overset{|}{C-H}}}}$

[Ans. (a) $H_3N^+ - \underset{H}{\overset{COO^-}{\underset{|}{\overset{|}{C-H}}}}$ **]**

4. Which one of the following is a wrong statement? *[QY-2019]*

(a) Glycogen is storage substance in fungus
(b) Glycogen is seen in liver cell
(c) Glycogen is seen in brain
(d) Glycogen is storage substance in animals

[Ans. (c) Glycogen is seen in brain]

5. Who sequenced the first protein insulin? *[HY-2019]*

(a) Linus Pauling
(b) Robert Corey
(c) Gerardus Johannes Mulder
(d) Fred Sanger **[Ans. (d) Fred Sanger]**

Very Short Answers — 2 MARKS

1. Give two examples of secondary metabolites used as drugs. *[Govt. MQP-2018]*

Ans. 1. Vinblastin, 2. Curcumin.

2. Monosaccharides are called 'Reducing sugars' but disaccharides are not. Why? *[Govt. MQP-2018]*

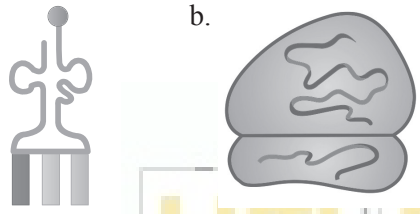
Ans. Sucrose is not a reducing sugar. The greater the concentration of reducing sugar, the more is the precipitate formed and greater is the colour change.

3. Write the properties of water. *[HY-2018 ; Sep-2020]*

Ans.
1. Adhesion and cohesion property.
2. High latent heat of vaporisation.
3. High melting and boiling point.
4. Universal solvent.
5. Specific heat capacity

4. Name the following diagrams. *[March-2019]*

a. b.



Ans. a. Transfer RNA (tRNA)
b. Ribosomal (rRNA).

5. What are the factors affecting the rate of enzyme reaction? *[Sep-2020]*

Ans. The **factors affecting the rate of enzyme reaction** are temperature, pH, enzyme concentration, substrate concentration, and the presence of any inhibitors or activators.

Short Answers — 3 MARKS

1. Starch is not a single material, but is regarded as a polysaccharide. (i) Prove the statement (ii) Name the bond formed between the monomers of them. *[QY-2019]*

Ans. **(i) Prove the statement:**
Starch is a storage polysaccharides made up of repeated units of amylose and amylopectin.
(ii) Amylopectin polymer cotain 1, 6 carbon bond.

Long Answers — 5 MARKS

1. Describe the structure of DNA with diagram. *[QY-2019; March-2020]*

Ans. **Structure of DNA:**

1. **Watson** and **Crick** shared the Nobel Prize in 1962 for their discovery, along with **Maurice Wilkins,** who had produced the crystallographic data supporting the model.
2. **Rosalind Franklin** (1920–1958) had earlier produced the first clear crystallographic evidence for a helical structure.
3. **James Watson** and **Francis Crick** of Cavendish built a scale model of double helical structure of DNA which is the most prevalent form of DNA, the B-DNA. This is the secondary structure of DNA.
4. DNA consists of right handed double helix with 2 helical polynucleotide chains that are coiled around a common axis to form right handed B form of DNA.
5. The coils are held together by hydrogen bonds which occur between complementary pairs of nitrogenous bases. The sugar is called **2′-deoxyribose** because there is no hydroxyl at position 2′.
6. Adenine and thiamine base pairs has two hydrogen bonds while guanine and cytosine base pairs have three hydrogen bonds. As published by **Erwin Chargaff** in 1949, a purine pairs with pyrimidine and vice versa.
7. Adenine (A) always pairs with Thymine (T) by double bond and Guanine (G) always pairs with Cytosine (C) by triple bond.

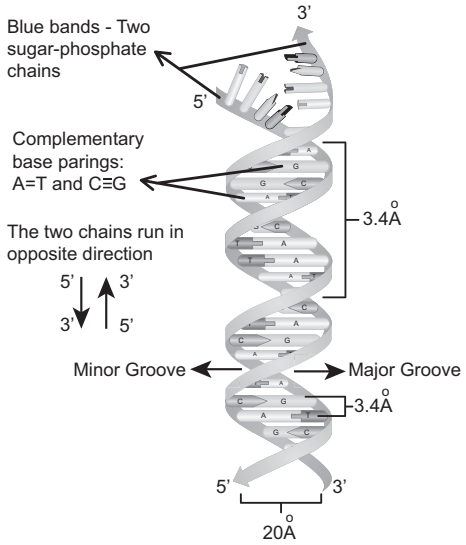
Chargaff 's Rule:

A = T; G ≡ C

A + G = T + C

A : T = G : C = 1

Features of DNA:



UNIT-IV

PLANT ANATOMY
(STRUCTURAL ORGANISATION)

Chapter 9

TISSUE AND TISSUE SYSTEM

CHAPTER SNAPSHOT

CONCEPT MAP

CLASSIFICATION OF MERISTEM

Position

APICAL MERISTEM
Present in apices of root and shoot. It is responsible for increase in the length of the plant, it is called as primary growth.

INTERCALARY MERISTEM
Occurs between the mature tissues. It is responsible for elongation of internodes.

LATERAL MERISTEM
Occurs along the longitudinal axis of stem and root. It is responsible for secondary tissues and thickening of stem and root. Example: vascular cambium and cork cambium.

Origin

PRIMARY MERISTEM
It is derived from embryonic stages and differentiated into primary permanent tissues.
Secondary meristem It is derived during later stage of development of the plant body. It produces cork cambium and interfascicular cambium.

SECONDARY MERISTEM
It is derived during later stage of development of the plant body. It produces cork cambium and interfascicular cambium.

Function

PROTODERM
It gives rise to epidermal tissue system and develops into epidermis,stomata and hairs.

PROCAMBIUM
It gives rise to primary vascular tissues. Example: xylem and phloem.

GROUND MERISTEM
It gives rise to all tissues except epidermis and vascular strands.

Plane of division

MASS MERISTEM
It divides in all planes. Example: endosperm,young embryo and sporangium

RIB MERISTEM OR FILE MERISTEM
It divides anticlinally in one plane. Example: development of cortex and pith

PLATE MERISTEM
It divides anticlinally in two planes. Example: development of epidermis

MUST KNOW DEFINITIONS

Tissue	:	Group of Cells that are alike in origin, structure and function.
Histology	:	Study of tissue.
Meristematic Tissue	:	Tissue with cells that have dense cytoplasm, prominent nucleus and most actively dividing cells.
Permanent Tissue	:	Meristematic cells which lose the power of division and become differentiated.
Simple Tisssue	:	A permanent tissue composed of one type of cells.
Aerenchyma	:	Parenchyma which has air in the intercellular spaces.
Stellate parenchyma	:	Star shaped parenchyma.
Collenchyma	:	A simple, mechanical tissue with unevenly thickened cell walls.
Sclerenchyma	:	A simple dead tissue with two kinds of cells. (Sclereids and Fibres)
Wood fibres	:	Fibres associated with secondary xylem tissue.
Bast fibres	:	Fibres associated with phloem.
Exarch Xylem	:	Protoxylem lies towards periphery and Metaxylem lies towards the centre of the vascular bundle.
Endarch Xylem	:	Protoxylem lies towards the centre and metaxylem lies towards periphery of the vascular bundle.
Halophiles	:	Plants growing in salty environment.
Xylem	:	Complex tissue made of four types of cells Tracheids, Vessels, Xylem paranchyma and Xylem fibres. Function - conduct water.
Phloem	:	Complex tissue made of four types of cells. Sieve elements, Companion cells, Phloem parenchyma and Phloem fibres. Function - Conduction of food.
Epidermal tissue	:	Outer most covering of plants.
Guard cells	:	Specialised epidermal cells which control the openings and closing of stomata.
Bulliform cells or Motor cells	:	Large and thin walled cells of upper epidermis in leaf to help in rolling and unrolling of leaf.
Casparian strips	:	The thickenings made of lignin and suberin found in radial and inner tangential walls of endodermis in roots.
Procambium	:	The first formed cambium which produces primary xylem and primary phloem.
Vascular cambium	:	Cambium formed during secondary growth in plants and produces secondary xylem and secondary phloem.
Radial Vascular bundle	:	Xylem and Phloem are arranged in different radii.
Collateral vascular bundle	:	Xylem and Phloem are arranged in the same radius.
Mesophyll	:	Tissue found in a leaf between the two epidermal layers.
Guttation	:	Loss of water in liquid form through openings called hydathodes in leaf surface.

Evaluation

1. Refer to the given figure and select the correct statement *[Mar-2020]*

i) A,B and C are histogen of shoot apex
ii) A Gives rise to medullary rays.
iii) B Gives rise to cortex
iv) C Gives rise to epidermis

(a) i and ii only (b) ii and iii only
(c) i and iii only (d) iii and iv only

[Ans. (c) i and iii only]

2. Read the following sentences and identify the correctly matched sentences. *[Mar-2020 ; Sep-2020]*

i) In exarch condition, the protoxylem lies outside of metaxylem.
ii) In endarch condition, the protoxylem lie towards the centre .
iii) In centrarch condition, metaxylem lies in the middle of the protoxylem.
iv). In mesarch condition, protoxylem lies in the middle of the metaxylem.

(a) i, ii and iii only (b) ii,iii and iv only
(c) i, ii and iv only (d) All of these.

[Ans. (c) i, ii and iv only]

3. In Gymnosperms, the activity of sieve cells are controlled by *[Sep-2020]*

(a) Nearby sieve tube members.
(b) Phloem parenchyma cells.
(c) Nucleus of companion cells.
(d) Nucleus of albuminous cells.

[Ans. (d) Nucleus of albuminous cells]

4. When a leaf trace extends from a vascular bundle in a dicot stem, what would be the arrangement of vascular tissues in the veins of the leaf? *[Mar-2020]*

(a) Xylem would be on top and the phloem on the bottom.
(b) Phloem would be on top and the xylem on the bottom.
(c) Xylem would encircle the phloem.
(d) Phloem would encircle the xylem.

[Ans. (a) Xylem would be on top and the phloem on the bottom]

5. Grafting is successful in dicots but not in monocots because the dicots have

(a) Vascular bundles arranged in a ring
(b) Cambium for secondary growth
(c) Vessels with elements arranged end to end
(d) Cork cambium

[Ans. (b) Cambium for secondary growth]

6. Why the cells of sclerenchyma and tracheids become dead?

Ans. **(i)** Sclerenchyma and tracheids are cells which have nucleus initially but it soon degenerates. They become dead cells.

(ii) Sclerenchyma functions to give mechanical strength to the plant. Tracheids are a part of xylem and help to conduct water.

(iii) They have functions inspite of being dead cells.

7. Explain sclereids with their types.

Ans. **Sclereids:**

(i) Sclereids are dead cells. They are isodiametric but some are elongated too.

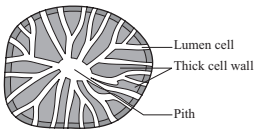
(ii) The cell wall is very thick due to lignification. Lumen is very much reduced.

(iii) The pits may simple or branched.

(iv) Sclereids are mechanical in function. They give hard texture to the seed coats, endosperms etc.

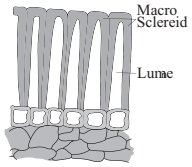
Types of Sclereids

(a) Brachysclereids or Stone cells:



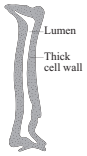
Isodiametric sclereids, with hard cell wall. It is found in bark, pith cortex, hard endosperm and fleshy portion of some fruits. Ex: Pulp of *Pyrus*.

(b) Macrosclereids:



Elongated and rod shaped cells, found in the outer seed coat of leguminous plants. Ex: *Crotalaria* and *Pisum sativum*.

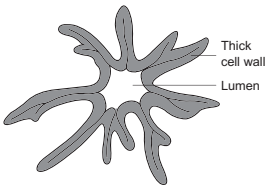
(c) Osteosclereids (Bone cells):



Rod shaped with dilated ends. They occur in leaves and seed coats. Ex: seed coat of *Pisum* and *Hakea*

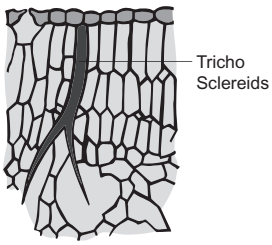
(d) Astrosclereids:

Star cells with lobes or arms diverging form a central body. They occur in petioles and leaves. Ex: *Tea*, *Nymphaea* and *Trochodendron*.



(e) Trichosclereids:

Hair like thin walled sclereids. Numerous small angular crystals are embedded in the wall of these sclereids, present in stems and leaves of hydrophytes. Example: *Nymphaea leaf* and Aerial roots of *Monstera*.



8. What are sieve tubes? Explain.

Ans.

(i) Sieve tubes are long tube like conducting elements in the phloem. These are formed from a series of cells called sieve tube elements.

(ii) The sieve tube elements are arranged one above the other and form vertical sieve tube.

(iii) The end wall contains a number of pores and it looks like a sieve. So it is called as sieve plate.

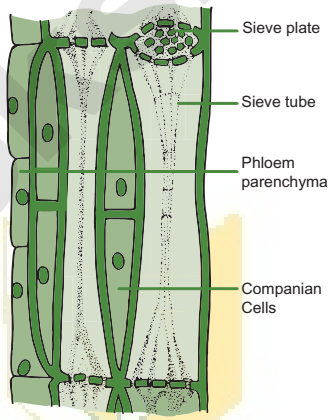
(iv) The sieve elements show nacreous thickenings on their lateral walls.

(v) They may possess simple or compound sieve plates.

(vi) The function of sieve tubes are believed to be controlled by companion cells.

(vii) 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.

(viii) 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.



Different types of phloem elements

9. Distinguish the anatomy of dicot root from monocot root.

Ans.

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

UNIT-IV

PLANT ANATOMY
(STRUCTURAL ORGANISATION)

Chapter 10

SECONDARY GROWTH

CHAPTER SNAPSHOT

MUST KNOW DEFINITIONS

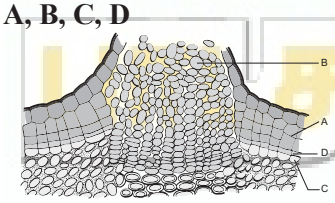
Vascular Cambium	:	The vascular cambium is the lateral meristem that produces the secondary vascular tissues.
Fusiform Initials	:	Vertically elongated cells found in vascular cambium.
Ray initials	:	Horizontally elongated cells found in vascular cambium.
Secondary xylem	:	Xylem formed by Vascular cambium.
Porous wood	:	Wood which contains vessels.
Non-Porous wood	:	Wood which does not contain vessels.
Spring wood / Early wood	:	Wood formed in spring and has large number of xylem elements.
Autumn wood / Late wood	:	Wood formed in winter and has few xylary elements.
Annual rings	:	Growth rings which are a continuation of early wood and late wood.
Diffuse prorous wood	:	Diffuse porous woods are woods in which the vessels or pores are rather uniform in size and distribution throughout an annual ring.
Ring porous woods	:	The pores of the early wood are distinctly larger than those of the late wood. Thus rings of wide and narrow vessels occur.
Sap Wood/ Alburnum	:	Living part of the wood
Heart Wood / Duramen	:	Dead part of the wood.
Periderm	:	Protective tissue consisting of phellem, phellogen, and phelloderm.
Phellem	:	The protective tissue composed of non-living cells with suberized walls and formed centrifugally (outward) by the phellogen (cork cambium) as part of the periderm.
Phellogen (Cork Cambium)	:	It is a secondary lateral meristem which produces phellem and phelloderm.
Bark	:	The term 'bark' is commonly applied to all the tissues outside the vascular cambium of stem (i.e., periderm, cortex, primary phloem and secondary phloem).

Evaluation

1. Consider the following statements
In spring season vascular cambium
(i) is less active
(ii) produces a large number of xylary elements
(iii) forms vessels with wide cavities of these,
(a) (i) is correct but (ii) and (iii) are not correct
(b) (i) is not correct but (ii) and (iii) are correct
(c) (i) and (ii) are correct but (iii) is not correct
(d) (i) and (ii) are not correct but (iii) is correct
[Ans. (b) (i) is not correct but(ii) and (iii) are correct]

2. Usually, the monocotyledons do not increase their girth, because
(a) They possess actively dividing cambium
(b) They do not possess actively dividing cambium
(c) Ceases activity of cambium
(d) All are correct **[Ans. (b) They do not possess actively dividing cambium]**

3. In the diagram of lenticel, identify the parts marked as A, B, C, D



(a) A. phellem, B. Complementary tissue, C. Phelloderm, D. Phellogen.
(b) A. Complementary tissue, B. Phellem, C. Phellogen, D. Phelloderm.
(c) A. Phellogen, B. Phellem, C. Phelloderm, D. complementary tissue
(d) A. Phelloderm, B. Phellem, C. Complementary tissue, D. Phellogen
[Ans. (a) A. phellem, B. Complementary tissue, C. Phelloderm, D. Phellogen]

4. The common bottle cork is a product of ***[Sep-2020]***
(a) Phellem (b) Phellogen
(c) Xylem (d) Vascular Cambium
[Ans. (b)Phellogen]

5. What is the fate of primary xylem in a dicot stem showing extensive secondary growth?
[Sep-2020; Sep-2021]
(a) It is retained in the center of the axis
(b) It gets crushed
(c) May or may not get crushed
(d) It gets surrounded by primary phloem
[Ans. (b) It gets crushed]

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

Ans. **(i)** When the bark of a tree is damaged, the tree first tries to seal the wound from the outside environment to prevent any microbial infection.
(ii) A reaction zone is created which alters the chemistry of the wood in the wounded area to avoid microbial infection.
(iii) Than the tree builds a barrier zone 'callus' to compartmentalize the wounded area.
(iv) The callus grow and cover/seals the wound. This allows new uncontaminated wood to grow on it.

7. In which season the vessels of angiosperms are larger in size, why? ***[Sep-2020]***

Ans. In the spring season, cambium is very active and produces a large number of xylary elements having vessels / tracheids with wide lumen. This is because in spring season the climatic conditions are favorable for the growth of plants with optimum temperature, light and photosynthesis is at the peak. This requires the uptake and transport of large quantities of water. Further the soil has good water content in spring unlike in summer / winter.

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

Ans. The secondary growth in dicots and gymnosperms is brought about by two lateral meristems.
• Vascular Cambium and
• Cork Cambium

Vascular Cambium

It is the lateral meristem that produces the secondary vascular tissues. i.e., secondary xylem and secondary phloem.

Origin and formation of Vascular Cambium

(i) A strip of vascular cambium that is believed to originate from the procambium is present between xylem and phloem of the vascular bundle. This cambial strip is known as intrafascicular or fascicular cambium.

(ii) In between the vascular bundles, a few parenchymatous cells of the medullary rays that are in line with the fascicular cambium become meristematic and form strips of vascular cambium. It is called interfascicular cambium.

(iii) This interfascicular cambium joins with the intrafascicular cambium on both sides to form a continuous ring. It is called a vascular cambial ring.

Organization of Vasular Cambium

(i) The active vascular cambium possesses cells with large central vacuole (or vacuoles) surrounded by a thin, layers of dense cytoplasm.

(ii) The most important character of the vascular cambium is the presence of two kinds of initials, namely, fusiform initials and ray initials.

Fusiform initials

(i) These are vertically elongated cells. They give rise to the longitudinal or axial system of the secondary xylem (tracheary elements, fibers, and axial parenchyma) and phloem (sieve elements, fibers, and axial parenchyma).

(ii) Based on the arrangement of the fusiform initials, two types of vascular cambium are recognized.

Storied (Stratified cambium) and Non-Storied (Non-stratified cambium):

Storied (Stratified cambium):

If the fusiform initials are arranged in horizontal tiers, with the end of the cells of one tier appearing at approximately the same level, as seen in tangential longitudinal section (TLS), it is called **storied (stratified) cambium**. It is the characteristic of the plants with short fusiform initials.

Non-storied (Non-stratified cambium):

(i) In plants with long fusiform initials, they strongly

(ii) overlap at the ends, and this type of cambium is called **non-storied (non stratified) cambium**.

Ray Initials

(i) Horizontally elongated cells.

(ii) They give rise to the ray cells and form the elements of the radial system of secondary xylem and phloem.

Activity of Vascular Cambium

(i) The vascular cambial ring, when active, cuts off new cells both towards the inner and outer side.

(ii) The cells which are produced outward form secondary phloem and inward secondary xylem.

(ii) Due to the continued formation of secondary xylem and phloem through vascular cambial activity, both the primary xylem and phloem get gradually crushed.

Phellogen (Cork Cambium)

(i) It is a secondary lateral meristem.

(ii) It comprises homogenous meristematic cells unlike vascular cambium.

(iii) It arises from epidermis, cortex, phloem or pericycle (extrastelar in origin).

(iv) Its cells divide periclinally and produce radially arranged files of cells.

(ii) The cells towards the outer side differentiate into phellem (cork) and those towards the inside as phelloderm (secondary cortex).

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

Ans. (i) The log A which was 50 years old will last longer for the merchant.

(ii) In a tree the centre part of the wood will be darker in colour and is called heart wood or duramen. Outer part of wood is called sap wood and is lighter in colour.

(iii) Sap wood is the living part of the wood formed newly.

(iv) The heart wood stops conducting water as the vessels are blocked by tyloses and becomes dead forming hardest part of the wood as the years go by.

(v) In the wood which is 50 years old the amount of heart wood would be large due to ageing. It would be more durable and can also resist microbes.

(vi) Log B which is only 20 years old will have lesser heart wood as compared to log A.

10. A transverse 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? *[Mar-2020]*

Ans. (i) The activity of vascular cambium is under the control of many physiological and environmental factors.

(ii) In the spring season, cambium is very active and produces a large number of xylary elements having vessels/tracheids with wide lumen.

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

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

(v) The tracheary elements are with narrow lumen, very thick walled.

(vi) The spring wood is lighter in colour and has a lower density whereas the autumn wood is darker and has a higher density.

(vii) The annual ring denotes the combination of early wood and late wood and the ring becomes evident to our eye due to the high density of late wood.

(viii) Sometimes annual rings are called growth rings but it should be remembered all the growth rings are not annual.

(ix) Additional growth rings are developed within a year due to adverse natural calamities like drought, frost, defoliation, flood, mechanical injury and biotic factors during the middle of a growing season,which results in the formation of more than one annual ring. Such rings are called **pseudo- or false- annual rings**.

(x) Each annual ring corresponds to one year's growth and on the basis of these rings, the age of a particular plant can easily be calculated.

(xi) The determination of the age of a tree by counting the annual rings is called **dendrochronology**.

Significance of growth ring:

(i) Age of wood can be calculated.

(ii) The quality of timber can be ascertained.

(iii) Radio-Carbon dating can be verified.

(iv) Past climate and archaeological dating can be made.

(v) Provides evidence in forensic investigation.

Botany Long Version Questions (for pure science Group)

Long Version Evaluation

1. **Refer Evaluation Q.No.1**

2. **Refer Evaluation Q.No.2**

3. **Refer Evaluation Q.No.3**

4. **Inner, darker & harder portion of secondary xylem that cannot conduct water in an older dicot stem is called** *[Sep-2021]*

(a) Alburnum
(b) Bast
(c) Wood
(d) Duramen **[Ans. (d) Duramen]**

5. **Refer Evaluation Q.No.4**

6. **Refer Evaluation Q.No.5**

Assertion and Reason:

7. **These questions consist of two statements each printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses.**

A. If both Assertion and Reason are true but the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both Assertion and Reason are false.

1. **Assertion :** In woody stems the amount of heart wood continue to increase year after Year

Reason : The activity of cambial ring continues uninterrupted.

(a) A (b) B (c) C (d) D **[Ans. (a) A]**

2. **Assertion :** Secondary growth in dicot roots occurs with the help of vascular cambium and phellogen.

Reason : Vascular cambium is completely primary in origin.

(a) A (b) B (c) C (d) D **[Ans. (c) C]**

Additional

Choose the Correct Answers 1 MARK

I. Choose the Correct options for the below Questions:

1. Which is the living part of the wood?
(a) Duramen (b) Heart wood
(c) Porous wood (d) Sap wood
[Ans. (d) Sap wood]

2. What is the name of the gymnosperm wood?
(a) non porous wood (b) hard wood
(c) porous wood (d) sap wood
[Ans. (a) non porous wood]

3. What is the name of the bark used as spice?
(a) Pinus (b) Cinchona
(c) Cinnamon (d) Morus
[Ans. (c) Cinnamon]

4. Which of the following is a part of radial system?
(a) sieve tubes (b) companion cells
(c) phloem rays (d) phloem parenchyma
[Ans. (c) phloem rays]

5. Which is fossil resin?
(a) Gum Arabic (b) Amber
(c) Turpentine (d) Latex
[Ans. (b) Amber]

II. Choose the Correct options for the below Fill in the blanks:

1. The wood formed in spring season is called ____ .
(a) Hard wood (b) Soft wood
(c) Early wood (d) Non porous wood
[Ans. (c) Early wood]

2. Quinine is obtained from the _____ of the cinchona tree.
(a) Root (b) resin
(c) bark (d) gum [Ans. (c) bark]

3. In *Morus*, the wood is described as _____ .
(a) soft wood (b) heart wood
(c) non porous wood (d) porous wood
[Ans. (d) porous wood]

4. Canada balsam is obtained from _____
(a) Abies (b) Haematoxylin
(c) Quercus (d) Cinchona
[Ans. (a) Abies]

5. Canada balsam is made from _____.
(a) gum (b) tannin
(c) latex (d) resin [Ans. (d) resin]

6. Bark does not include _____ .
(a) cortex (b) periderm
(c) pith (d) secondary phloem
[Ans. (c) pith]

7. Lenticels are seen in _____ .
(a) Phelloderm, (b) phellem
(c) phellogen (d) epidermis
[Ans. (b) phellem]

8. Gum Arabic is got from _____ .
(a) Acacia (b) Pinus
(c) Quercus (d) Hevea
[Ans. (a) Acacia]

9. In dicot root, periderm originates from _____ .
(a) cortex (b) pericycle
(c) xylem (d) medullary rays
[Ans. (b) pericycle]

III. Identify the correct Statements:

1. Identify the correct statements from the below about "Heart wood"
(I) Dead part of the wood
(II) Situated in the centre part of wood
(III) Dark in colour
(IV) Hard in nature
(a) I and II only (b) I and IV only
(c) I, II, III and (IV) (d) I and III only
[Ans. (c) I, II, III and IV]

2. Identify the correct statements from the below about "Lenticel".
(I) Lenticel is raised opening or pore on the epidermis.
(II) Formed during secondary growth is stems.
(III) Lenticel helpful in exchange of gases.
(IV) Formed during primary growth in stems
(a) I and IV only (b) I and II only
(c) I, II and III only (d) I and II only
[Ans. (c) I, II and III only]

3. Identify the correct statements from the below about "Importance of studying growth rings".

(I) Age of wood can be calculated.

(II) Radio - Carbon dating can be verified.

(III) Past climate and archaeological dating can be made.

(IV) Provides evidence in forensic investigation.

(a) I and IV only (b) I, II and III only

(c) I, II, III and IV (d) I and III only

[Ans. (c) I, II, III and IV]

IV. Identify the wrong statements:

1. Identify the wrong statement from the below about "Sap wood".

(a) Living part of the wood

(b) Very soft in nature

(c) Situated on centre part of wood

(d) Tyloses are absent

[Ans. (c) Situated on centre part of wood]

2. Identify the wrong statement from the below about "Cork cambium".

(a) It's also called phellogen

(b) It comprises homogenous cells

(c) It produces phellem (cork)

(d) It arises from procambium

[Ans. (d) It arises from Procambium]

3. Identify the wrong statement from the below about "Fusiform initials".

(a) These are vertically elongated cells

(b) Give rise to the longitudinal or axial system

(c) Give rise to ray cells

(d) There is short and long fusiform initials

[Ans. (c) Give rise to ray cells]

4. Identify the wrong statement from the below

(a) Intrafascicular cambium originates from procambium.

(b) It is a part of primary meristem.

(c) Interfascicular cambium is present inside the vasular bundle

(d) It is a part of secondary meristem.

[Ans. (c) Interfascicular cambium is present inside the vasular bundle]

V. Match the following:

1.

1.	Hard wood	(i) Duramen
2.	Heart wood	(ii) Porous wood
3.	Soft wood	(iii) Alburnum
4.	Sap Wood	(iv) Non – porous wood

	1	2	3	4
(a)	i	ii	iii	iv
(b)	iv	iii	ii	i
(c)	ii	i	iv	iii
(d)	iv	iii	ii	i

[Ans. (c) 1-ii, 2-i, 3-iv, 4-iii]

2.

1.	Phellum	(i) Cork cambium
2.	Phellogen	(ii) Secondary cortex
3.	Phelloderm	(iii) Cork
4.	Phelloids	(iv) lack suberin

	1	2	3	4
(a)	iii	ii	v	i
(b)	iii	i	ii	iv
(c)	ii	i	iii	iv
(d)	i	ii	iii	iv

[Ans. (b) 1 - iii, 2 - i, 3 - ii, 4 - iv]

3.

1.	Quinine	(i) Phellem layer of bark tissue
2.	Cork	(ii) *Quercus suber*
3.	Shuttle cocks	(iii) *Hevea brasiliensis*
4.	Rubber	(iv) Antimalarial compound

	1	2	3	4
(a)	iv	i	ii	iii
(b)	i	ii	iii	iv
(c)	ii	iii	iv	i
(d)	i	iii	iv	ii

[Ans. (a) 1 - iv, 2 - i, 3 - ii, 4 - iii]

4.

1.	Turpentine	(i) Jewellery
2.	Cinnamomum bark	(ii) *Pinus*
3.	Gum Arabic	(iii) Medicine for Cardiac stimulant
4.	Fossil resins Amber	(iv) *Acacia Senegal*

	1	2	3	4
(a)	i	iv	iii	ii
(b)	i	ii	iii	iv
(c)	ii	iii	iv	i
(d)	ii	iv	iii	i

[Ans. (c) 1 - ii, 2 - iii, 3 - iv, 4 - i]

UNIT-V

PLANT PHYSIOLOGY
(FUNCTIONAL ORGANISATION)

Chapter 11

TRANSPORT IN PLANTS

CHAPTER SNAPSHOT

CONCEPT MAP

TRANSPORT IN PLANTS

- Long Distance Transport
  - Translocation of Solutes
    - Mechanism
    - Path
  - Minefal Absorption
  - Transpiration
    - Factors
    - Measurement
    - Theories.
  - Water transport in plant
    - Distribution
      - Ascent of Sap
    - Absorption
      - Osmotic active
      - Non Osmotic active
- Short Distance (Cell to Cell transport)
  - Active
    - Channel Protein
    - Carrier Protein
    - Pumps
  - Passive
    - Diffusion
    - Facilitated diffusion,
      - Carrier Protein
      - Channel Protein
    - Imbibition
    - Osmosis
      - Endosmosis
      - Exosmosis
      - Plasmolysis
      - Deplasmolysis
      - Reverse Osmosis
- Types
  - Structure of Stomata

MUST KNOW DEFINITIONS

Diffusion	:	The net movement of molecules from a region of their higher concentration to a region of their lower concentration along a concentration gradient until an equilibrium is attained.
Imbibition	:	Colloidal systems such as gum, starch, proteins, cellulose, agar, gelatin when placed in water, will absorb a large volume of water and swell up. These substances are called imbibants and the phenomenon is imbibition.
Osmotic pressure	:	A solution and its solvent (pure water) are separated by a semipermeable membrane. A pressure is developed in the solution, due to the presence of dissolved solutes. This is called osmotic pressure.
Osmotic potential	:	Osmotic potential is defined as the ratio between the number of solute particles and the number of solvent particles in a solution.
Turgor Pressure	:	Pressure exerted by the cell membrane towards the cell wall is Turgor Pressure.
Wall pressure	:	The cell wall reacts to turgor pressure with equal and opposite force, and the counter-pressure exerted by the cell wall towards cell membrane is wall pressure.
Diffusion Pressure Deficit (DPD)	:	The difference between the diffusion pressure of the solution and its solvent at a particular temperature and atmospheric pressure is called as Diffusion Pressure Deficit.
Endosmosis	:	Endosmosis is defined as the osmotic entry of solvent into a cell or a system when it is placed in a pure water or hypotonic solution.
Exosmosis	:	Exosmosis is defined as the osmotic withdrawal of water from a cell or system when it is placed in a hypertonic solution.
Ascent of Sap	:	The water within the xylem along with dissolved minerals from roots is called sap and its upward transport is called ascent of sap.
Embolism	:	Gas bubbles expanding and displacing water within the xylem element is called cavitation or embolism.
Transpiration Pull	:	A pull is generated by the process of transpiration which is known as transpiration pull.
Transpiration	:	The loss of excess of water in the form of vapour from various aerial parts of the plant is called transpiration.
Antitranspirants	:	The term antitranspirant is used to designate any material applied to plants for the purpose of retarding transpiration.
Epithem	:	Pores called hydathodes are present over a mass of loosely arranged cells with large intercellular spaces called epithem.
Phloem loading	:	The movement of photosynthates (products of photosynthesis) from mesophyll cells to phloem sieve elements of mature leaves is known as phloem loading.

Evaluation

1. In a fully turgid cell *[June-2019]*

(a) DPD = 10 atm; OP = 5 atm; TP =10 atm
(b) DPD = 0 atm; OP = 10 atm; TP =10 atm
(c) DPD = 0 atm; OP = 5 atm; TP = 10 atm
(d) DPD = 20 atm; OP = 20 atm; TP = 10 atm

[Ans. (b) DPD = 0 atm; OP = 10 atm; TP = 10 atm]

2. Which among the following is correct?

i) apoplast is fastest and operate in nonliving part
ii) Transmembrane route includes vacuole
iii) symplast interconnect the nearby cell through plasmadesmata
iv) symplast and transmembrane route are in living part of the cell

(a) i and ii (b) ii and iii
(c) iii and iv (d) i, ii, iii, iv

[Ans. (c) iii and iv]

3. What type of transpiration is possible in the xerophyte *Opuntia*? *[Sep-2020; Sep-2021]*

(a) Stomatal (b) Lenticular
(c) Cuticular (d) All the above

[Ans. (c) Cuticular]

4. Stomata of a plant open due to *[Sep-2020]*

(a) Influx of K^+ (b) Efflux of K^+
(c) Influx of Cl^- (d) Influx of OH^-

[Ans. (a) Influx of K^+]

5. Munch hypothesis is based on

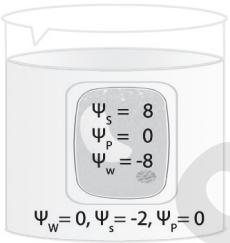
(a) Translocation of food due to TP gradient and imbibition force
(b) Translocation of food due to TP
(c) Translocation of food due to imbibition force
(d) None of the above

[Ans. (b) Translocation of food due to TP]

6. If the concentration of salt in the soil is too high and the plants may wilt even if the field is thoroughly irrigated. Explain. *[Sep-2020]*

Ans. 1. High salt concentration results in high osmotic potential of the soil solution, so the plant has to use more energy to absorb water.
2. Under extreme salinity conditions, plants may be unable to absorb water and will wilt even if the surrounding soil is thoroughly irrigated.

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



Ans. 1. The discovery of enzyme phosphorylase in guard cells by Hanes (1940) greatly supports the starch-sugar interconversion theory.
2. The enzyme phosphorylase hydrolyses starch into sugar and high pH followed by endosmosis and the opening of stomata during light. The vice versa takes place during the night.

8. List out the non-photosynthetic parts of a plant that need a supply of sucrose? *[Sep-2020]*

Ans. 1. Roots
2. Stems of Older Plants
3. Flowers and fruits

9. What are the parameters which control water potential? *[Mar-2020]*

Ans. 1. The concept of water potential was introduced in 1960 by Slatyer and Taylor.
2. Water potential is potential energy of water in a system compared to pure water when both temperature and pressure are kept the same.
3. It is also a measure of how freely water molecules can move in a particular environment or system. Water potential is denoted by the Greek symbol Ψ (psi) and measured in Pascal (Pa).
4. At standard temperature, the water potential of pure water is zero.
5. Addition of solute to pure water decreases the kinetic energy thereby decreasing the water potential.
6. Comparatively a solution always has low water potential than pure water. In a group of cells with different water potential, a water potential gradient is generated.
7. Water will move from higher water potential to lower water potential.

Water potential (Ψ) can be determined by,

- Solute concentration or Solute potential (Ψ_S)
- Pressure potential (Ψ_P)

By correlating two factors, water potential is written as,

$$\Psi_W = \Psi_S + \Psi_P$$

Water Potential = Solute potential + Pressure potential

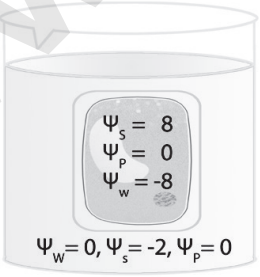
a) Solute Potential (Ψ_S)

1. Solute potential, otherwise known as osmotic potential denotes the effect of dissolved solute on water potential.
2. In pure water, the addition of solute reduces its free energy and lowers the water potential value from zero to negative.
3. Thus the value of solute potential is always negative. In a solution at standard atmospheric pressure, water potential is always equal to solute potential ($\Psi_W = \Psi_S$).

b) Pressure Potential (Ψ_P)

1. Pressure potential is a mechanical force working against the effect of solute potential.
2. Increased pressure potential will increase water potential and water enters cell and cells become turgid.
3. This positive hydrostatic pressure within the cell is called Turgor pressure. Likewise, withdrawal of water from the cell decreases the water potential and the cell becomes flaccid.

10. 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.

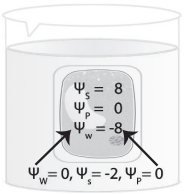
b) Is the solution outside the cell isotonic, hypotonic or hypertonic?

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 reasons

Ans. (a)



(b) The solution outside the cell is hypotonic.

(c) The cell is hypertonic

(d) The cell will become more turgid.

(e) **Endosmosis .**

Reason : Endosmosis is defined as the osmotic entry of solvent into a cell when it is placed in pure water / Hypotonic solution. The solution in the beaker outside the cell is pure water (ψ_w = O). and water enters into the artificial cell which is placed inside the beaker of pure water.

GOVERNMENT EXAM QUESTIONS

Bio-Botany (Short version)

CHOOSE THE CORRECT ANSWERS 1 MARK

1. Pulsation theory was proposed by _____ .

(a) J.C.Bose *[HY-2018]*

(b) Godlewski

(c) Strasburger

(d) Stephen Hales **[Ans. (a) J.C.Bose]**

2. Who proposed the "Theory of photosynthesis in guard cells"? *[June-2019]*

(a) Von Mohl

(b) Sayre

(c) Levit

(d) Steward **[Ans. (a) Von Mohl]**

3. The water loss in Cuticular transpiration is

(a) 90 - 95% *[HY-2019]*

(b) 0.1%

(c) 5 - 10%

(d) 40-45% **[Ans. (c) 5 - 10%]**

MCQ'S

Chapter 1

1. **Which of the following are found in extreme saline conditions?** (NEET-2017)
   (a) Archaebacteria (b) Eubacteria
   (c) Cyanobacteria (d) Mycobacteria
   [Ans. (a) Archaebacteria]

2. **Select the mismatch** (NEET – 2017)
   (a) *Frankia* – *Alnus*
   (b) *Rhodospirillum* – *Mycorrhiza*
   (c) *Anabaena* – *Nitrogen fixer*
   (d) *Rhizobium* – *Alfalfa*
   [Ans. (b) *Rhodospirillum* - *Mycorrhiza*]

3. **Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?** (NEET – 2017)
   (a) *Bacillus* (b) *Pseudomonas*
   (c) Mycoplasma (d) *Nostoc*
   [Ans. (c) Mycoplasma]

4. **Five Kingdom system of classification suggested by R.H. Whittaker is not based on** (AIPMT – 2014)
   (a) Presence or absence of a well defined nucleus
   (b) Mode of reproduction
   (c) Mode of nutrition
   (d) Complexity of body organisation
   [Ans. (a) Presence or absence of a well defined nucleus]

5. ***Mycorrhizae* are the example of** (NEET – 2017)
   (a) Fungitasis (c) Amensalism
   (b) Antibiosis (d) Mutualism
   [Ans. (d) Mutualism]

6. **Which of the following shows coiled RNA strand and capsomeres?** (AIPMT – 2014)
   (a) Polio virus (b) Tobacco mosaic virus
   (c) Measles virus (d) Retrovirus
   [Ans. (b) Tobacco mosaic virus]

7. **Viroids differ from viruses in having :** (NEET – 2017)
   (a) DNA molecules with protein coat
   (b) DNA molecules without protein coat
   (c) RNA molecules with protein coat
   (d) RNA molecules without protein coat
   [Ans. (d) RNA molecules without protein coat]

8. **Which of the following is correctly matched for the product produced by them?** (NEET – 2017)
   (a) *Acetobacter acetic* : Antibiotics
   (b) *Methanobacterium* : *Lactic acid*
   (c) *Penicillium notatum* : *Acetic acid*
   (d) *Saccharomyces cerevisiae* : Ethanol
   [Ans. (d) *Saccharomyces cerevisiae* : Ethanol]

9. **Which of the following components provides sticky character to the bacterial cell?** (NEET – 2017)
   (a) Cell wall (b) Nuclear membrane
   (c) Plasma membrane (d) Glycocalyx
   [Ans. (d) Glycocalyx]

10. **Which of the following statements is wrong for viroids?** (NEET – 2016)
    (a) They lack a protein coat
    (b) They are smaller than viruses
    (c) They causes infections
    (d) Their RNA is a high molecular weight
    [Ans. (d) Their RNA is a high molecular weight]

11. Which of the following would appear as the pioneer organisms on bare rocks? (NEET – 2016)

(a) Lichens (b) Liverworts
(c) Mosses (d) Green algae

[Ans. (a) Lichens]

12. One of the major components of cell wall of most fungi is (NEET – 2016)

(a) Chitin (b) Peptidoglycan
(c) Cellulose (d) Hemicellulose

[Ans. (a) Chitin]

13. Which one of the following statements is wrong? (NEET – 2016)

(a) Cyanobacteria are also called blue-green algae
(b) Golden algae are also called desmids
(c) Eubacteria are also called false bacteria
(d) Phycomycetes are also called algal fungi

[Ans. (c) Eubacteria are also called false bacteria]

14. Which part of the tobacco plant is infected by *Meloidogyne incognita*? (NEET – 2016)

(a) Flower (b) Leaf
(c) Stem (d) Root

[Ans. (d) Root]

15. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the kingdom (NEET – 2016)

(a) Animalia (b) Monera
(c) Protista (d) Fungi

[Ans. (b) Monera]

16. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the (NEET – 2016)

(a) Halophiles (b) Thermoacidophiles
(c) Methanogens (d) Eubacteria

[Ans. (c) Methanogens]

Chapter 2

1. Read the following statements (A to E) and select the option with all correct statements (AIPMT – 2015)

A. Mosses and Lichens are the first organisms to colonise a bare rock.
B. Selaginella is a homosporous pteridophyte.
C. Coralloid roots in Cycas have VAM.
D. Main plant body in bryophytes is gametophytic, whereas in pteridophytes it is sporophytic.
E. In gymnosperms, male and female gametophytes are present within sporangia located on sporophyte.

(a) B, C and E (b) A, C and D
(c) B, C and D (d) A, D and E

[Ans. (d) A, D and E]

2. An example of colonial alga is (NEET – 2017)

(a) *Chlorella* (b) *Volvox*
(c) *Ulothrix* (d) *Spirogyra*

[Ans. (b) *Volvox*]

3. Select the mismatch (NEET – 2017)

(a) *Pinus* - Dioecious
(b) Cycas - Dioecious
(c) Salvinia - Heterosporous
(d) Equisetum - Homosporous

[Ans. (a) Pinus -Dioecious]

4. Life cycle of Ectocarpus and Fucus respectively are (NEET – 2017)

(a) Haplontic, Diplontic
(b) Diplontic, Haplodiplontic
(c) Haplodiplontic, Diplontic
(d) Haplodiplontic, Halplontic

[Ans. (c) Haplodiplontic, Diplontic]

5. Zygote meiosis is characterisitic of (NEET – 2017)

(a) *Marchantia* (b) *Fucus*
(c) *Funaria* (d) *Chlamydomonas*

[Ans. (d) *Chlamydomonas*]

6. In bryophytes and pteridophytes, transport of male gametes require (NEET – 2016)

(a) Wind (b) Insects
(c) Birds (d) Water

[Ans. (d) Water]

7. **Monoecious plant of Chara shows occurrence of** (NEET-2013)
   (a) Stamen and carpel on the same plant
   (b) Upper antheridium and lower oogonium on the same plant
   (c) Upper oogonium and lower antheridium on the same plant
   (d) Antheridiophore and archegonio- phore on the same plant
   [Ans. (c) Upper oogonium and lower antheridium on the same plant]

8. **Read the following five statement (A-E) and answer as asked next to them** (AIPMT Prelims – 2012)
   (a) In Equisetum, the female gametophyte is retained on the parent sporophyte
   (b) In Ginkgo, male gametophyte is not independent
   (c) The sporophyte in *Riccia* is more developed than that in Polytrichum
   (d) Sexual reproduction in Volvox is isogamous
   (e) The spores of slime moulds lack cell walls
   How many of the above statement are correct?
   (a) Two (b) Three
   (c) Four (d) One **[Ans. (d) One]**

9. **Flagellated male gametes are present in all the three of which one of the following sets?** (AIPMT Prelims – 2007)
   (a) *Riccia, Dryopteris* and *Cycas*
   (b) *Anthoceros*, *Funaria* and *Spirogyra*
   (c) *Zygnema*, *Saprolegnia* and *Hydrilla*
   (d) *Fucus*, *Marsilea* and *Calotropis*
   [Ans. (a) *Riccia*, *Dryopteris* and *Cycas*]

10. **Ectophloic siphonostele is found in** (AIPMT Prelims – 2005)
   (a) *Adiantum* and Cucurbitaceae
   (b) *Osmunda* and *Equisetum*
   (c) *Marsilea* and *Botrychium*
   (d) *Dicksonia* and maiden hair fern
   [Ans. (b) *Osmunda* and *Equisetum*]

11. **Select the correct statement** (NEET – 2016)
   (a) Gymnosperms are both homosporous and heterosporous
   (b) *Salvinia*, *Ginkgo* and *Pinus* all are gymnosperms
   (c) Sequoia is one of the tallest trees
   (d) The leaves of gymnosperms are not well adapted to extremes of climate
   [Ans. (c) Sequoia is one of the tallest trees]

12. **Seed formation without fertilization in flowering plants involves the process of** (NEET – 2016)
   (a) Sporulation
   (b) Budding
   (c) Somatic hybridization
   (d) Apomixis **[Ans. (d) Apomixis]**

Chapter 3

1. **Leaves become modified into spines in** [AIPMT-2015]
   (a) Silk cotton (b) Opuntia
   (c) Pea (d) Onion **[Ans. (b) *Opuntia*]**

2. **Keel is the characteristic feature of flower of** [AIPMT-2015]
   (a) Tomato (b) Tulip
   (c) Indigofera (d) Aloe **[Ans. (c) *Indigofera*]**

3. **Perigynous flowers are found in** [AIPMT-2015]
   (a) Rose (b) Guava
   (c) Cucumber (d) China rose **[Ans. (a) Rose]**

4. **Which one of the following statements is correct** [AIPMT-2014]
   (a) The seed in grasses is not endospermic
   (b) Mango is a parthenocarpic fruit
   (c) A proteinaceous aleurone layer is present in maize grain
   (d) A sterile pistil is called a staminode
   [Ans. (c) A proteinaceous aleurone layer is present in maize grain]

5. **An example of edible underground stem is** [AIPMT-2014]
   (a) Carrot (b) Groundnut
   (c) Sweet potato (d) Potato
   [Ans. (d) Potato]