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GLOSSARY

A

Abscission layer: The layer of dead cells in a leaf that prevents the movement of material into or out of the leaf; forms in autumn.

Abscission zone: That zone containing the tissues which brings about the abscission of organs such as leaves, fruits and flowers.

Abscission: The separation of leaves, flowers and fruits from plants after the formation of an abscission zone at the base of their petioles, peduncles and pedicels.

Acid: A type of compound that contains hydrogen and dissociates in water to produce positive hydrogen ions.

Adaptation: Any change in the structure or functioning of an organism that makes it better suited to its environment.

Adventitious organ: An organ which develop in an unusual position.

Adventitious root: Set of buds developing in internodes or on roots, or of root developing along stems or on leaves.

Alkaline: A nitrogen-containing base in which at least one nitrogen is part of a ring; example include nicotine, caffeine, cocaine, and strychnine.

Amino acid: Any of a group of water-soluble organic compounds that posses both

a carboxyl and amino group attached to the same carbon atom called the a-carbon atom. A minuit structure which form protein.

Anabolism: The synthetic processes by which cells or organism makes new and more complex materials from simpler substances. These processes are generally energy consuming, e.g. photosynthesis.

Anaphase: The period of mitosis during which centromeres split and sister chromatids become separate chromosomes that begin to move toward opposite poles of the spindle apparatus.

Anatomy: The study of the structure of living organisms, especially of their internal parts by means of dissection and microscopical examination.

Angiosperm: Flowering plants distinguished from gymnosperm by the presence of carpel that enclose the seeds.

Annual ring: A single season's production of xylem (wood) by the vascular cambium.

Anthocyanin: Pigmented glycosylated flavonoids responsible for most of the red, pink, purple and blue colours in plants.

Apex: The terminal portion of the shoot or root in which the apical meristem is located.

Apical cell: The single initial cell present in the apical meristem of some roots and shoots; typical of many lower vascular plants.

Apical meristem: Group of undifferentiated cells that divide to produce increase in length of stems and roots.

ATP: Adenosine triphosphate, a molecule with three phosphate groups found in all living cells; it is the principal for energy storage and exchange in cell metabolism.

Auxanometer: Any mechanical instrument or measuring device used to study the growth or movement of plant organs.

Axillary Bud: A bud in the axil of a leaf.

B

Bark: Tree structure that includes all tissues outside the vascular cambium, including phloem, cork cambium and cork.

Biomass: Total amount of living matter within a given area or habitat .

Primary Body: That part of the plant which develops from the primary meristems, apical and intercalary.

Secondary Body: That part of the plant, comprising the secondary vascular tissues and periderm, which is added to the primary body as a result of the activity of the lateral meristem, i.e. the cambium and phellogen.

Botany: The scientific study of plants and plant - like organisms

Bryophytes: A group of non vascular seedless plants, such as mosses and liverworts, which grow in logs, marshes, or on forest floors.

Bud: Plant structure containing undeveloped tissue that can produce new stems and leaves.

Bundle sheath: A layer or layers of cells surrounding the vascular bundles of leaves; may consist of parenchyma or sclerenchyma.

C

Callus: Undifferentiated mass of parenchymatous cells formed due to unorganised cell division of a tissue.

Cambium: A lateral meristerm from which the secondary vascular tissues, i.e. secondary xylem and phloem develop.

Casparian strip: Waterproof strip that surrounds the body and is softer and more flexible than bone.

Cell body: Largest part of a typical neuron; contains the nucleus and much of the cytoplasm.

Cell membrane: The semi - permeable membrane that surrounds the cytoplasm and is next to the cell wall; also called the plasma membrane or the plasmalemma.

Cell plate: That part of the wall which develops between the two daughter nuclei during telophase.

Cell sap: The liquid contents of a vacuoles.

Cell specialisation: The process in which cells develop in different ways to perform different tasks.

Cell wall: Strong supporting layer around the cell membrane in plants, algae and some bacteria.

Cell: The basic structural and functional unit of living organisms; in plants it consists of protoplasm surrounded by a cell wall.

Chlorophyll: Principal pigment of plants and other photosynthetic organisms; captures light energy.

Chloroplast: Organelle found in cells of plants and some other organisms that captures the energy from sunlight and converts it into chemical energy.

Chromoplast: A plastid containing pigments other than chlorophyll; the pigment other than chlorophyll; the pigments are usually yellow to orange.

Chromosome: Threadlike structure within the nucleus containing the genetic information that is passed from one generation of cells to the next.

Collenchyma: Type of ground tissue cell with a strong, flexible cell wall; helps support larger plants.

Companion cell: Specialised cell derived from the same parent cell as the closely associated sieve-tube member immediately adjacent to it (in angiosperm phloem).

Cork cambium: Lateral meristematic tissue that produces the outer covering of stems.

Cork: Tissue composed of cells whose walls are impregnated with suberin at maturity; the outer layer of tissue of an older woody stem; produced by the cork cambium.

Cortex: A primary tissue composed mainly for parenchyma; the tissue usually extends between the epidermis and the vascular tissue.

Cristae: System of parallel ridges formed by the inner membrane of a mitochondrion; site of chemical reactions that produce ATP.

Cuticle: A waxy layer of varying thickness made up of cutin present on epidermal tissue. It helps to retard the transpiration from leaves.

Cutin: A polymer of long-chain fatty acids that forms the main constituent of the cuticle of epidermal plant cells.

Cytokinesis: The division of the cytoplasm to form two separate daughter cells immediately after mitosis.

Cytology: the study of cell.

Cytoplasm: Material inside the cell membrane not including the nucleus.

D

Development: Changes that occur in organisms resulting from growth and differentiation of its cells into tissues and organs.

Dicotyledon: Angiosperm whose seeds have two cotyledons.

Differentiation: The physiological and morphological changes leading to specialisation which occur in a cell, tissue, organ or entire plant during the process of development from a meristematic or juvenile state to a mature one.

Diploid: The number of chromosomes in a body cell; consists of two sets of chromosomes.

DNA: Standard abbreviation of deoxyribonucleic acid, the carrier of genetic information in cells and viruses.

E

Endoderm: The innermost of the three primary germ layers in animal embryos; lines the archenteron and gives rise to the liver, pancreas, lungs and the lining of the digestive tract.

Endodermis: Layer of cells that completely encloses vascular tissue.

Endoplasmic Reticulum (ER): Internal membrane system in cells in which lipid components of cell membrane are assembled and some proteins are modified.

Endosperm: Food rich tissue that nourishes a seedling as it grows.

Epidermal cell: Cell that makes up the dermal tissue, which is the outer covering of a plant.

Epidermis: The exterior tissue, usually one cell thick, of leaves, young stems and roots and other parts of plants.

Eukaryotic: Type of cell that has a nucleus.

F

Fibrous root: Part of a root system in which roots branch to such an extent that no single root grows larger than the rest.

Flavonoid: One of a group of naturally occurring phenolic compounds, many of which are plant pigments.

Flower: Seed bearing structure of an angiosperm.

Food vacuole: Small cavity in the cytoplasm of protists that temporarily stores food.

G

Gamete: A reproductive cell that fuses with another gamete to form a zygote. Examples of gametes are ova and spermatozoa.

Gaseous exchange: The transfer of gases between an organism and the external environment in either direction. It occurs by diffusion across a concentration gradient and includes the exchange of oxygen and carbon dioxide in respiration and photosynthesis.

Germination: The beginning of or resumption of growth of a seed with the outward difference of the radicle or spore.

Golgi apparatus: Stack of membranes in the cell that modifies, sorts, and packages proteins from the endoplasmic reticulum.

Golgi body: A cell organelle composed of stacked cisternae each producing vesicles at the periphery. Also called dictyosome.

Grana (pl.)/**Granum** (sing.): A stack of platelike bodies (thylakoids), many of which are found in plant chloroplast (each chloroplast contains about 50 grana). Grana bear the light-receptive pigment chlorophyll and contain the enzymes responsible for the light reaction of photosynthesis.

Ground meristem: Meristem that produces all the primary tissues other than the epidermis and stele.

Ground tissue: All plant tissue formed by the apical meristerms except the epidermis and vascular tissue e.g. cortex, pith and primary medullary rays.

Growth ring: A growth layer in secondary xylem or secondary phloem, as seen in cross section.

Growth tissue: Tissue that occurs throughout a plant and whose functions include storage, metabolism, and support.

Growth: Progressive increase in size and volume through natural development.

Guard cell: Specialised cell in the epidermis of plants that controls the opening and closing of stomata by responding to changes in water pressure.

Gymnosperm: An early type of seed plant, distinguished from angiosperms by having seeds borne unprotected in cones.

H

Haploid: Describing a nucleus, cell or organism with a single set of unpaired chromosomes.

Hard wood: A woody dicot

Heartwood: Nonliving, usually darker-colored wood whose cells have ceased to function in water conduction.

Herbaceous: Non-woody stems with little or no secondary growth.

Herbivores: Animals that eats vegetation, especially any of the plant eating mammals, such as ungulates (cows, horses, etc).

Histology: The microscopic study of the tissues of living organisms.

Homeostasis: The regulation by an organism of the chemical composition of its body fluids and other aspects of its internal environment so that physiological processes can proceed at optimum rates. Its involves monitoring changes in the external and internal environment by means of receptors and adjusting the composition of the body fluids accordingly.

Homologous: Describing a character that is shared by a group of species because it is inherited from a common ancestor.

I

Intercalary: Occurring between differentiated tissues, for example, intercalary meristem, which is not part of the apical meristem, occurs in the internodes of grasses (between leaf nodes) and enables longitudinal growth of the stem.

Internode: The part of a plant stem between two nodes.

Interphase: The period following the completion of cell division, when the nucleus is not dividing. During this period changes in both the nucleus and the cytoplasm result in the complete development of the daughter cells.

Ion: An atom or group of atoms that has either lost one or more electrons, making

positively charged (a cation), or gained one or more electrons, making it negatively charged (an anion).

L

Latex: A milky fluid of mixed composition found in some herbaceous plants and trees. Its function is not clear but it may assist in protecting wounds (compare gum) and it may be involved in the nutrition of the plant.

Leaf: A flattened, usually photosynthesis structure arranged in various ways on a stem.

Leaflet: One of the subdivisions of a compound leaf

Legume: A dry fruit formed from a single carpel and containing one or more seeds, which are shed when mature.

Lenticels: Any of the raised pores in the stems of woody plants that allow gas exchange between the atmosphere and the internal tissues.

Leucoplasts: Colourless plastids which store starch, lipids and proteins and in which glucose is changed to starch.

Lignin: Substance in vascular plants that makes cell walls rigid.

Lipid: Macromolecule made mainly from carbon and hydrogen atoms; includes fats, oils, and waxes.

Lumen: The space enclosed by a vessel, duct, or other tubular or sacklike organ. The central cavity of blood vessels and of the digestive tract are examples.

Lysosome: Cell organelle filled with enzymes needle to break down certain materials in the cell.

M

Marginal meristem: Plant tissue that forms the flattened blade and the stalklike petiole that attaches the blade to the stem.

Matrix: The component of tissues (e.g bone and cartilage) in which the cells of the tissue are embedded.

Maturation: The process of becoming fully developed, especially the final phase in the development of germ cells, which renders the egg or sperm capable of fertilisation.

Meiosis: The process of two successive nuclear divisions through which segregation of genes occurs and a single diploid (*2n*) cell becomes four haploid (*n*) cells.

Meristem: Cluster of tissue that is responsible for continuing growth throughout a plant's lifetime.

Meristematic tissue: Plant tissue found only in the tips of shoots and roots; responsible for plant growth.

Mesophyll: Specialised ground tissue that makes up the bulk of most leaves; performs most of a plant's photosynthesis

Metabolism: Set of chemical reactions through which an organism builds up or breaks down materials as it carries out its life processes.

Metaphase: The period of mitosis during which chromosomes become attached to spindle fibre, which align the chromosomes in a circular plane that is perpendicular to the microtubules of the spindle apparatus.

Microfilaments: A meristematic tissue is made up of meristematic cells.ny of numerous microscopic protein fibres, typically 3 6nm in diameter that form one of the main components of the cytoskeleton of eukaryotic cells.

Microscope: Device that produces magnified images of structures that are too small to see with the unaided eye.

Microtubule: A microscopic tubular structure, with an external diameter of 24nm and of variable length, found in a wide range of eukaryotic cells.

Middle lamella: A thin layer of adhesive extra-cellular material, primarily

found between the primary walls of adjacent young plant cells.
Midrib: The central vein of a pinnately veined leaf or leaflet.

Mineral: Inorganic chemical compound usually made with two or more elements..

Mitochondrion: A structure within the cytoplasm of eukaryotic cells that carries out aerobic respiration, it is the site of the krebs cycle and electron transport chain and therefore the cell's energy production.

Mitosis: A type of nuclear division that results in two daughter cells each having a nucleus containing the same number and kind of chromosomes as the mother cell.

Monocotyledon: Angiosperm whose seeds have one cotyledon.

Morphology: The study of the form and structure of organisms, especially their internal form.

Mutation: A sudden random change in the genetic material of a cell that may cause it and all cells derived from it to differ in appearance or behaviour from the normal type.

N

Node: Point on a stem where a leaf is attached.

Nuclear envelop: The double membrane that separates the nucleoplasm of a cell from the cytoplasm.

Nuclear membrane: Layer of two membranes that surrounds the nucleus of a cell.

Nucleic acid: A complex organic compound in living cells that consists of a chain of nucleotides.

Nucleolus: Small, dense region within most nuclei in which the assembly of proteins begins.
Nucleus: The center of the atom which contains the protons and neutrons; in cells,

activities.

Nutrient: Chemical substance that an organism requires to live.

O

Organ: any distinct part of an organism that is specialised to perform one or a number of functions.

Organelle: Specialised structure that performs important cellular functions within a eukaryotic cell.

Osmosis: Diffusion of water through a selectively/different permeable membrane.

P

Palisade cells: Layer of tall, column-shaped mesophyll cells just under the upper epidermis of a leaf.

Palisade mesophyll: Layer of tall, column-shaped mesophyll cells just under the upper epidermis of a leaf.

Parenchyma: Type of ground tissue cell with a thin cell wall and large central vacuole.

Part of cell division: Part of the root tip that includes the apical meristem; where new root cells are produced.

Peptide: Any of a group of organic compounds comprising two or more amino acids linked by peptide bonds.

Pericycle: The layer of cells surrounding the xylem and phloem of roots; produces branch roots**.**

Periderm: The protective tissue that replaces epidermis; includes cork (phellem), cork cambium (phellogen), and phelloderm.

Perixosome: An organelle found in the cytoplasm of virtually all plant and animal cells that contains several enzymes involved in oxidation processes.

Petiole: Thin stalk by which a leaf blade is attached to a stem.

Petri dish: A shallow circular flat-bottomed dish made of glass or plastic and having a fitting lid. It is used in laboratories chiefly for culturing bacteria and other micro-organisms.

pH: A symbol of hydrogen ion concentration indicating the degree of acidity or alkalinity.

Phloem: Vascular tissue responsible for the transport of nutrients and the carbohydrates produced by photosynthesis.

Photosynthesis: Process by which plants and some other organisms use light energy to convert water and carbon dioxide into oxygen and high-energy carbohydrates such as sugars and starches.

Phylogenetic: Describing a system of classification of organisms that aims to show their evolutionary history.

Phylum: A category used in the classification of organism that consists of one or several similar or closely related classes.

Pigment: Light absorbing molecule.

Piliferous layer: A specialised cell in the root which gives rise to a root hair.

Pit: A depression or cavity in the secondary wall of a plant cell that facilitates the movement of substances between adjacent cells.

Pith: The core of the central vascular cylinder of monocot roots, consisting of parenchyma cells, which are ringed by vascular tissue; ground tissue interior to vascular.

Plant anatomy: Is the study of the internal structure of plants.

Plasma membrane: The outer boundary of the protoplasm of a cell; also called cell membrane, particularly in animal cells.

Plasmodesmata: A thin, cytoplasmic strand which passes through a pore in the cell wall, and which usually connects the protoplasts of two adjacent cells.

Plastids: An organelle within a plant cell, often occurring in large numbers. Apart from the nucleus, plastids are the largest solid inclusions in a plant cell.

Polysaccharide: Large macromolecule formed from monosaccharides.

Primary cell wall: The usually thin cell wall that forms during cell division; it is part of

Primary growth: Type of plant growth that occurs at the tips of roots and shoots.

Primary permanent tissues: Meristematic tissues found at the apex of the stem and root (apical meristerm) give rise to primary tissues.

Primary thickening: In some monocot, the meristem that increases the thickness of the shoot axis.

Primary xylem: The supporting and water-conducting tissue of vascular plants, consisting primarily of tracheids and vessels derived from primary growth of primary growth of primary meristem.

Prophase: The first stage of cell division, during which chromosomes contract and divide along their length (except for the centromeres) into chromatids.

Protoderm: The meristerm of the epidermis.

Protoplasm: The material comprising the living contents of a cell, i.e. all the substances in a cell except large vacuoles and material recently ingested or to be excreted.

Protoplast: The living unit of a cell, consisting of the nucleus and cytoplasm bounded by the cell membrane.

Protoxylem: The primary xylem tissue that is formed in the expanding region of roots and shoots before the shoot or root has completed the elongation process.

Q

Quiescent centre: A region in the root apical meristerm of seed plants in which the mitotic activity is very low or almost nil.

R

Reproduction: The production of new individuals more or less similar in form to the parent organism.

Respiration: The chemical reactions in a cell in which oxygen is used to released energy from nutrients; the exchange of gasses between cells and the surrounding environment; breathing.

Rhizoid: One of a group of delicate and often colourless hairlike outgrowth found in certain algae and the gametophyte generation of bryophytes and ferns.

Ribosome: A small spherical body within a living cell that is the site of protein synthesis.

Root cap: A thimble-shaped mass of cells at the tip of a growing root; functions primary in protection.

Root hair: The fine, hair-like, unicellular projections from single cells of the epidermis of a root in the zone near the root apex.

Root pressure: Positive pressure of roots that forces water up the stem; caused by active movement of minerals in root cells that draws water into the vascular system.

Root: Underground organ in plants that absorbs water and minerals.

S

Saprophytes: Organisms that live on and use dead organic materials for food.

Sapwood: Area in plants that surrounds heartwood and is active in fluid transport.
Scalariform: The parallel arrangement, one near the other, of elongated structures in the cell wall of an element.

Sclereids: Sclerenchyma cells found in tissues varying from pear fruits to the hard shells of some nuts.

Sclerenchyma: Tissue composed of lignified cells with thick walls, the tissue functions primarily in strengthening and support.

Secondary cell wall: The cell wall that forms interior to the primary cell wall only after cell division is completed; it is restricted to contain cells and often contains lignin.

Secondary growth: Growth derived from lateral meristems (e.g. the vascular cambium and cork cambium.

?**Secondary permanent tissue:** Meristematic tissues which lie laterally in strips of elongated cells in the stem give rise to secondary permanent tissues.

Secondary phloem: Phloem derived from the outer vascular cambium.

Secondary tissue: A tissue produced by the vascular cambium or the cork cambium (e.g. virtually all the xylem and phloem in a tree trunk).

Secondary xylem: Xylem formed by the vascular cambium, wood.

Shoot: The aerial part of a vascular plants. It develops from the plumule and consists of a stem supporting leaves, buds and flowers.

Sieve plate: An area of the wall of a sieve-tube member that contains several to many perforations that permit cytoplasmic strands being larger than plasmodesmata.

Sieve tube: A row of cells which conduct food from photosynthetic plant parts to the growing points and storage organs. It is a part of the phloem tissue.

Simple permanent tissue: When a permanent consists of only one cell type, it is referred to as simple permanent tissue.

Specialized cell: Cell that is uniquely suited to performing a particular function.

Spherosome: A small spherical organelle found in the cytoplasm of plant cell.

Spongy mesophyll: Loose tissue beneath the palisade layer of a leaf.

Sporophyte: The generation in the life cycle of a plant that produces spores. The sporophyte is diploid but its spores are haploid. It is either completely or partially dependent on the gametophyte generation in mosses and liverworts, but is the dominant plant in the life cycle of clubmosses, horsetails, ferns and seed plants.

Stele: The central vascular cylinder of roots and stems.
Stem, Supporting structure that connects roots and leaves and carries water and nutrients between them.

Stoma: Opening in the underside of a leaf that allows carbon dioxide and oxygen to diffuse into and out of the leaf.

Stomata: Openings along the upper and lower leaf epidermis through which gases are exchanged and water vapour is lost.

Stroma: The matrix between the grana in chloroplasts; the site of the biochemical (i.e. "dark") reactions of photosynthesis.

Suberin: The mixture of waxy substances, similar to cutin, present in the thickened cell walls of many trees and shrubs, particularly in corky tissues.

System: A naturally occurring group of objects or phenomena; the solar system is an example; a set of objects or phenomena grouped together for classification or analysis.

T

Taproot: Primary root found in some plants that grows longer and thicker than other roots.

Telophase: The period of mitosis during which chromosomes seem to mimic prophase in reverse; chromosomes steadily elongate and decondense back into diffuse chromatin and each new daughter nucleus becomes surrounded by a nuclear envelop.
Thylakoid: The membrane inside a chloroplasts; they occur in stacks as grana or individually as frets.

Tissue: A collection of cells of similar structure organised to carry out one or more particular functions.

G**round Tissue:** all the mature plant tissues except the epidermis, periderm and vascular tissues.

Mature Tissue: A tissue which has undergone differentiation.

Mechanical Tissue: A tissue comprised of cells, the walls of which are more or less thickened; such tissues give support to the plant body. Also referred to as supporting tissues.

Tonoplast: The single membrane that bounds the vacuole of plant cells.

Tracheid: Hollow plant cell in xylem tissue with thick cell walls that resist pressure.

Tracheophyte: Any plant that has elaborate tissues, including vascular tissue; a conspicuous sporophyte generation and complex leaves with water proof cuticles.

Translocation: The movement of soluble foods from green leaves and storage organs to all plant parts that need them.

Transmission: The one way transfer of a nerve impulse from one neurone to another across a synapse.

Transpiration: Loss of water vapour from a plant through its leaves.

Trichomes: A hair-like projection from a plant epidermal cells. Examples include root hairs and the stinging hairs of nettle leaves.

Tubulin: A protein of which the microtubules of cells are formed.

Tylose: A balloon-like extension of a parenchyma cell that protrudes into the lumen of a neighbouring xylem vessel or trachied through a pit in the cell wall.

U

Undifferentiated cells: These are cells which have not become modified to perform a particular function. Examples are the cells of spirogyra and volvox.

V

Vacuole: A pocket of fluid that is separated from the cytoplasm of a cell by a membrane; it may occupy more than 99% of a cell's volume in plants; also, food storage or contractile pockets within the cytoplasm of unicellular organisms.

Vascular bundle: Strand of xylem and phloem tissues running from the roots into the leaves. It conducts water, mineral salts and food throughout the plant and supports the softer tissues.

Vascular cambium: A narrow cylindrical sheath of cells that produces secondary xylem and phloem in stems and roots.

Vascular plant: A plant having xylem and phloem.

Vascular system: A specialised network of vessels for the circulation of fluid throughout the body tissues of an animal.

Vascular tissue: Tissue specialized for long-distance transport of water and mineral; xylem and phloem.

Vein: A term applied to any of the vascular bundles that form a branching network within leaves.

Vessel: One of usually very numerous cylindrical "tubes" whose cells have lost their cytoplasm; occur in the xylem of most angiosperm and a few other vascular plants; each vessel is composed of vessel members laid end to end; the perforated or open-ended walls of the vessel members permits water to pass through freely.

W

Water vascular system: System of internal tubes in echinoderms that carries out essential functions such as feeding, respiration, circulation, and movement.

Wood: Secondary xylem

Woody plants: An entire plant or a plant organ with well-developed secondary xylem.

Xylem: The tissue through which most of the water and dissolved minerals utilised by a plant are conducted; it consists of several types of cells.

Z

Zone of cell division: Part of the root tip that includes the apical meristem, where new root cells are produced.

Zone of cell elongation: Part of the root, adjacent to the apical meristem, in which newly formed cells elongate.

Zone of maturation: Part of the root in which immature, elongated root cells begin to take on specific functions.

Zygote: A fertilised female gamete, the product of the fusion of the nucleus of the ovum or ovule with the nucleus of the sperm or pollen grain.

APPENDICES

APPENDIX ONE
STUDY QUESTIONS PART ONE

The Plant Cell

1. (a) Identify the parts of the cell at ultra structure level.
   (b) Explain the functions of the various parts identified.

2. (a) Draw and describe the various organelles within the cell.
   (B) Explain the theory of formation of certain structures such as vacuoles and cell wall.

3. (a) Describe the structure and organisation of plant cell walls.
   (b) List and describe non-protoplasmic contents of the cell.

4. Describe different types of crystals and their sources/distribution,

Tissue System in Plants

1. (a) Make a large labeled drawing in your practical notebook showing the different tissues found in a plant body .
   (b) Explain the differences between a monocotyledonous and dicotyledonous plant.

2. (a) Describe the distribution of various tissues in the root, stem and leaf portions of the plant.

(b) Compare and contrast the different presentations of tissue patterns in the root and stem of monocotyledonous and dicotyledonous plant.

3. Examine, identify and draw sections of the various parts of plants to show the distribution of various tissues.

Primary Tissue Organisation

1. (a) Arrange in the correct order of tissues from the outermost to the innermost portion of the plant.
   (b) In your practical class, identify plant tissues in both the transverse and longitudinal sections using appropriate microscope.

2. (a) With the help of your laboratory instructor, macerate the plant body by chemical treatment to isolate any required tissue components.
   (b) Describe the observed difference in transition regions of tissues.

Secondary Growth in Plants

1. (a) Explain growth in thickness in plants.
   (b) Explain the role of meristems in secondary growth.

2. (a) Prepare sections of regions of growth for microscopic observation.
   (b) Examine, identify and draw the structure.

3. (a) Explain the process of cork formation.
   (b) Differentiate between growth in monocotyledonous and dicotyledonous plants.

4. Describe the process of wound healing and leaf fall.

STUDY QUESTIONS PART TWO

Scope of Plant Anatomy and Histology

1 (a) In few sentences highlight the importance of plant anatomy as a basic science.
(b) Define the term plant and explain the role of plants in the study of Botany.

2. Explain the relationship between plant anatomy and

(a) Cytology
(b) Histology
(c) Seed bearing plants.

Diversity of cell type, structure and specialisation

1.(a) Describe the function of the large central vacuoles in the plant cell.
(b) Although many plant cells contain chloroplast, they are absent in some types of plant cells. Explain
2.(a) Describe the function of chloroplast
(b) Name the photosynthetic pigment contained in chloroplast.
(c) Name a type of plant cell that may not have chloroplasts.

Characteristics and structure of the plant body

1. What are the three systems that make up plant body?

2. List three functions of roots
   (a) The tips of growing roots contain fine, hair-like structures that extend outward into spaces between soil particle. How would these structures function for the plant?
   (b) What function do roots have from which you might benefit when eating your evening meal?
   (c) How does the general shape of a root system serve to anchor the plant against strong winds?

3. You are provided with a complete dicot plant *(Talinum traingulare)* and a monocot (e.g. Grass) plant. Examine the dicot plant carefully.
   (a) How does it differ from the typical angiosperm drawing.
   (b) Make a diagram to show the position of the leaves, flowers and buds on the stem of the dicot plant.
   (c) Compare both monocot and dicot pants. In what ways do they differ?

Histology of Plant Tissues

(1) (a) Illustrate the structure of a typical plant cell wall.
(b) What do you understand by primary wall and secondary wall. Explain each term.

(2) (a) Draw and label the following cell types: meristerm, parenchyma, ,

collenchyma, fibre, tracheids and vessel.

(b) State two functions of collenchyma tissue.

(c) Distinguish between (i) Dermal tissue and (ii) Ground tissue

(3) (a) State three basic tissue systems of an angiosperm leaf.

(b) State the position of parenchyma tissue in plants.

(c) State three differences between monocot and Dicot plants.

Anatomy of Leaves

1. (a) Botanically, what is a leaf?
   (b) What are three ways that leaves are adapted to carry on photosynthesis?
2. List the tissues of a leaf and state the function of each.

3. Make a large labeled drawing to illustrate the opening and closing of stomata in a leaf.

4. Explain the formation of abscission layer at the base of a leaf

Anatomy of Stems

1. (a) Contrast the arrangement of the vascular tissues in monocot and dicot stem.
   (b) Name two plants that lack true vascular tissues (xylem and phloem).
   (c) Explain how a lack of vascular tissue places limit on the size to which plants can grow.

2. (a) Explain the function of xylem
   (b) Explain the function of phloem.
   (c) Described two differences between xylem and phloem.

3. (a) Name one way in which xylem is strengthened in a mature plant.
   (b) Explain the purpose of the holes in the sieve plate at the ends of each sieve tube cell.

4. (a) Name the cell type in the phloem that actually conducts the sugar solution.
   (b) What is the purpose of the companion cell in the phloem tissue.

Anatomy of Roots

1. Explain the purpose of the root hairs.

2. Explain why it is necessary for the root tip to be covered by a protective cap of cells.

3. The xylem and phloem of the root are continuous with the xylem and phloem of the stem and leaves. Explain why this continuous system of tubes is necessary for the plants.

Microscopy

1. (a) Describe a situation were phase contrast microcopy will improve image quality.
   (b) List two structures that could be seen by light microscope in a plant cell.
   (c) Determine the magnification of a microscope using
   (a) 15 x eyepiece and 40 x objective lens (b) 10 x eyepiece and 60 x objective lens.

2. (a) Describe the main difference between a bright field light microscope and a disserting microscope.
   (b) Explain the difference between magnification and resolution (resolving power) with respect to microscope use.

3. (a) Which two types of microscope view the surface of an object?
   (B) Which two types of microscopes view objects that have been sliced and treated to improve contrast?
   (c) Of the microscopes just mentioned, which one resolves the greater amount of detail?

APPENDIX TWO
SPECIMEN EXAMINATION QUESTIONS

EXAMINATION QUESTIONS: SPECIMEN 1

Instruction: Attempt all questions in section A and any two in section B

Section A (20 Marks)

1. Define the term anatomy.
2. Mention two main parts of a plant.
3. State two functions of angiosperm root.
4. Two regions of the root are …….. and …….
5. Define the term meristem
6. Name two types of simple tissue
7. Two functions of parenchyma tissue are …….. and …….
8. State one main function of phloem tissue
9. Two types of mesophyll in angiosperm leaf are ..... and .....
10. Two functions of the tracheids are .....and.....

Section B (40 Marks)

1 (a) State two functions of collenchyma tissue.
(b) Make a large labeled diagram to show the following simple plant tissue: (i) transverse section (TS) of parenchyma tissue (ii) longitudinal section (LS) of collenchyma tissue.

2. (a) State three basic tissue systems of angiosperm leaf.
(b) State one main function of guard cells in leaf.
(c) Make a large labeled drawing of the cross section of a dicot root to show its essential features and state the function of peliterous layer.

3. (a) State the position of parenchyma tissue in plant.
(b) State three differences between monocot and dicot plants.
(c) Make a labeled drawing of the transverse section of a tree trunk.

EXAMINATION QUESTIONS: SPECIMEN 2

Instruction: Attempt all Questions in section A and any two in section B

Section A

1. Anatomy is the study of the _____ of living plants, while Histology is the microscopic study of _____ living plants.

2. A tissue is defined as a group of _____ of the same _____ or of the mixed _____, while spermatophytes are divided into two subdivision namely _____ and _____

3. Meristematic tissue occurs at the _____ growing points of a plant, while it is thin walled and lack _____ and _____

4. Important feature of meristematic tissues is their ability to _____ and subsequently differentiate into _____

5. Another name for parenchyma tissue is _____, while its cells frequently contain _____ and therefore also function as _____

6. Vascular tissue is concerned with _____ of materials, within the plants, it is made up of _____ and _____

7. Cells are usually bounded by a _____ or _____ within each such boundary, constant _____ occur, while the scientist who study cell is called _____.

8. The body of plant is composed of two fundamental parts called _____ and _____, while the visible loss water from plants into the air is called _____.

9. Plant commonly lose into the air an amount of _____ appropriately their own _____ in a _____

10. _____ and _____ are two main parts of the roots system.

Section B

Attempt any three questions from this section

1. (a) What are complex tissues?
   (b) Mention two types of complex tissues.
   (c) Mention the different elements that make up the xylem tissue.
   (d) State two functions of each of the mentioned elements.

2. (a) Define the term permanent tissues
   (b) Name any four simple tissues found in plants.
   (c) Mention one position where each of the mentioned tissues could be found in plant.
   (d) State two functions for each of the mentioned tissues.

3. (a) Discuss the anatomy of dicot stem.
   (b) What is leaf abscission?
   (c) Discuss secondary thickening growth in roots.

EXAMINATION QUESTIONS: SPECIMEN 3

Instructions: Attempt all questions in Section A and any two in section B

1. The science which deals with the knowledge about plant is called _____, while chloroplasts are the most important because these are the sites at which _____ takes place.

2. _____ is internal conducting tissue for the movement of water, minerals and food, while the mitochondria are very complex organelles which provide _____ for cell functions.

3. The main chemical constituent of the middle lamella is _____, while _____ are water soluble pigments which are also found in the cell sap.

4. Three of the principal organs of a living plants are _____, _____ and _____.

5. Roots anchor plants in the ground holding soil in place and preventing _____, while the root system of a living plant absorbs water and dissolved _____.

6. Plant histology is the study of _____ in plant, while plant anatomy is the study of _____.

7. In parenchymatous tissue, the cells are not closely _____, while it also serves as a _____ tissue and may store water or food.

8. The thick waxy coating of the epidermal cells is known as the _____, while the main phloem cells are _____ tube elements.

9. _____ cells have extremely thick, rigid cells walls that make ground tissue tough and strong while epidermal cells whose outer walls posses a _____ protect the plant from excessive water loss.

10. The meristematic cells are capable of _____ and so a meristematic tissue is growing tissue, while primary growth of stems is produced by _____ in apical meristerm.

11. The presence of thickening at the corner of the cells gives some _____ to organs where the tissue occurs.

12. Tracheids have greatly thickened _____ with only very harrow lumen, while the leaves of a plant are its main organs of _____.

13. The epidermis of many leaves is also covered by the structure called _____, while the bulk of most leaves consist of a specialized ground tissue known as _____.

14. Guard cells are epidermal cells found on the _____ of leaves, while the stomata open and close in response to changes in _____ within the guard cells.

15. The blade is attached to stem by a thin stalk called _____, while primary growth occurs only in the _____ of the plant.

16. The primary tissue of all stems is composed of _____ which usually contains _____.

Section B: Attempt any two questions only

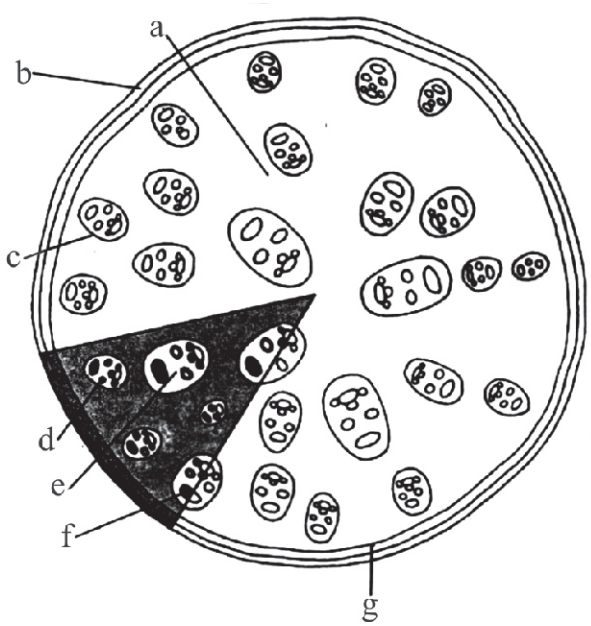
1. (a) Make a large labeled drawing of a cross section of a Dicot Leaf to show its essential features. The length of your drawing should fall between 8 - 10cm.

   (b) State the functions of the following organelles.
   (i) Stoma (ii) Guard cell

   (c) State **two** functions of the tracheids in xylem vessel

2. (a) When the root of a Dicot Plant is examined from the apex upward state **four (4)** regions that may be differentiated.

   (b) (i) Label the parts a g of the cross section of a monocot stem as shown in the sketch below and (ii) comment on the arrangement of the vascular bundles.



(c) Give the functions of the parts labeled d and f in the sketch above.

3. (a) Make a large labeled drawing of a cross section of a Dicot Root to show its essentialfeatures. The length of your drawing should fall between 7 - 8cm.

(b) Differentiate between: (i) Primary Permanent Tissue and Secondary Permanent Tissue. (ii) Simple Permanent Tissue and Complex Permanent Tissue.

(c) Vessels are also known as tracheae. They are cylindrical and tube like cells joint end to end, based on the type of thickening, vessels are recognized either as (i) Annular (ii) Spiral (iii) Scalariform (iv) Reticulate. Represent diagrammatically the structures of above mentioned vessels.

APPENDIX THREE
ANSWERS TO TUTORIAL QUESTIONS

CHAPTER ONE

1. anatomy
2. histology
3. similar
4. cells
5. tissue
6. waxy cuticle
7. guard cells
8. root hairs
9. photosynthesise
10. chemical
11. successful
12. organisms
13. botany
14. central
15. dilute
16. ion
17. rough
18. chemical reaction
19. protoplasmic
20. plant histology
21. growing
22. building
23. differentiated

CHAPTER TWO

1. cytoplasm
2. proteins
3. differentially
4. ribosomes
5. disk-shaped
6. leucoplast
7. photosynthesis
8. energy
9. Adenosine triphosphate
10. middle lamella

11. pectin
12. plasmodesma/plasmodesmata
13. middle lamella
14. polysaccharide
15. electrons
16. chemical reactions
17. primary wall
18. flavonoids
19. cluster
20. Woods/fibres

CHAPTER THREE

1. power
2. vascular tissue
3. photosynthetic
4. similarities
5. support
6. plastids
7. embryo
8. vascular system
9. flowering
10. seed bearing
11. tissues
12. roots, stems, leaves
13. leaves
14. nutrients
15. division
16. drugs
17. two
18. erosion
19. enter
20. sunlight
21. small, moist
22. transport
23. reproduce
24. transport, stems
25. reproduction
26. scale-like
27. flowers, fruits

CHAPTER FOUR

1. young
2. cell division, cell enlargement, cell differentiation
3. cell wall, daughter
4. differentiation
5. absorb, turgid
6. volume/size
7. growth
8. dry weight
9. moisture
10. mitosis, meiosis
11. size, weight
12. meristerm
13. fertilisation
14. sigmoid growth curve
15. root cap
16. auxanometer
17. chromatin
18. centromere
19. meristerms
20. two
21. haploid, chromosomes
22. four
23. pre existing
24. genes, variation

CHAPTER FIVE

1. cells, functions
2. meristematic tissues
3. meristematic
4. apical, lateral and intercalary meristerms
5. generate
6. permanent, power
7. cellular differentiation
8. parenchyma, collenchyma and sclerencyma
9. irregularly, cellulose
10. water and food
11. mechanical strength
12. sclereids
13. lignin and suberin

14. complex tissue
15. xylem and phloem
16. xylem parenchyma
17. phloem fibre
18. water and gases
19. periderm
20. companion cells, secondary walls
21. suberine
22. mucilage, latex and resins.

CHAPTER SIX

1. cells, tissues
2. dermal, vascular, ground
3. dermal, epidermal cells
4. cuticle
5. guard, gas
6. transport, water, nutrients
7. xylem, phloem
8. tracheids, vessels
9. sieve tube, companion
10. roots, stems, leaves
11. reproductive structures
12. skin
13. Warehouse, metabolism
14. leaf, fuzzy appearance
15. water loss, gas exchange
16. xylem, phloem
17. dead
18. no secondary wall
19. callose
20. parenchyma, collenchyma, sclerenchyma
21. support
22. sclerenchyma

CHAPTER SEVEN

1. photosynthesis
2. light
3. cuticle
4. petiole
5. photosynthesis

6. stomata
7. guard cells
8. mesophyll
9. palisade mesophyll
10. leaves
11. stomata
12. undersides
13. water pressure
14. closes
15. plants
16. petiole
17. moist
18. right angles
19. structure
20. air

CHAPTER EIGHT

1. water, minerals
2. water, mineral
3. storage system
4. epidermal cells, waxy
5. woody tissue
6. scattered, ringlike
7. end
8. cell division
9. parenchyma, stored food
10. meristematic
11. palm trees, grasses.
12. xylem, phloem
13. vascular cambium, cork cambium
14. secondary growth
15. ring

CHAPTER NINE

1. water, and nutrients
2. ground
3. slippery
4. cell differentiation
5. root hairs
6. parenchymatous

7. protoxylem
8. active transport proteins.
9. water molecules
10. active transport
11. osmosis
12. outer surface
13. similar epidermal
14. water loss
15. root hairs
16. thick-walled cells
17. parenchyma
18. vascular cylinder
19. cortex
20. secondary tissues

CHAPTER TEN

1. microscope
2. magnified
3. microscope
4. electromagnets
5. resolving power
6. light
7. parfocal, higher power
8. depth of field
9. wet mount
10. analogous
11. specimen, lenses

CHAPTER ELEVEN

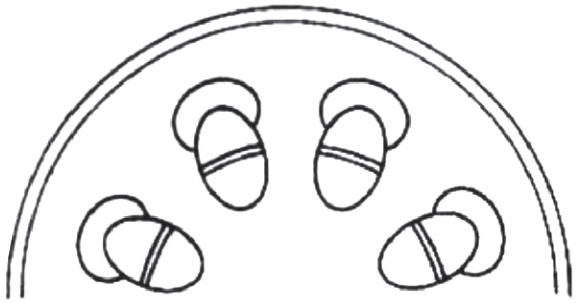
1. representation
2. centrally
3. purpose
4. reported speech
5. tabular form
6. magnification
7. successful
8. language
9. sectioned
10. Items, experiments.

CHAPTER TWELVE

1. razor, materials
2. symmetry
3. watch
4. lens, contact
5. low, high
6. primary, thickness
7. thickening
8. solvent
9. transverse
10. secondary thickening

APPENDIX FOUR
ADVANCED STUDY QUESTIONS

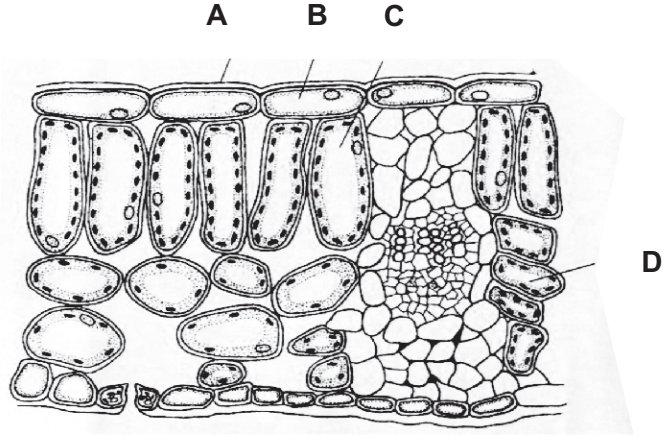
1. (a) The plan shows the distribution of tissues in part of a transverse section of a young stem of *Helianthus*. Shade the main regions where cambium would be found.



(b) Name the main supporting tissue found in the stem of a woody perennial plant.

(c) Briefly describe how additional supporting tissue is formed as the woody stem increases in girth.

2. The diagram is of a vertical section through a dicotyledonous leaf.



(a) Name the parts labeled A to D.

(b) Describe three features shared by leaves that make them efficient gas exchange surfaces.

(c) Describe two ways in which leaves as gas exchange surfaces.

3. (a) Give details of the main cell types which make up the xylem tissue in the stem of flowering plants.

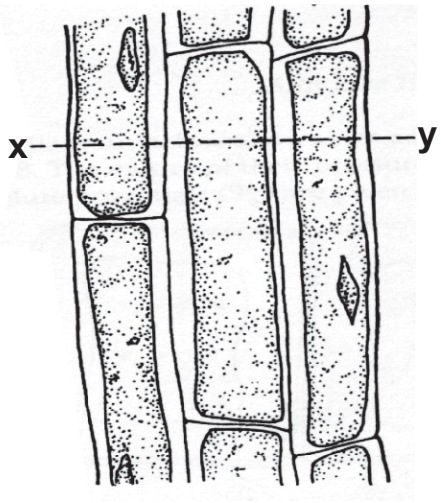
(b) Indicate how the structure and distribution of xylem is related to its functions.

4. (a) Give an illustrated account of the structure of the phloem tissue in a herbaceous flowering plant.

(b) The table below refers to xylem and phloem tissue in flowering plants. If the statement is correct, place a tick (v) in the appropriate box and if the statement is incorrect, place a cross (X) in the appropriate box.

Statement	Xylem	Phloem
May contain tracheids		
Contains cells with living contents.		
Contains lignified cells		
Transports organic products of photosynthesis.		
Unidirectional transport		
Transport inhibited by metabolic poisons.		

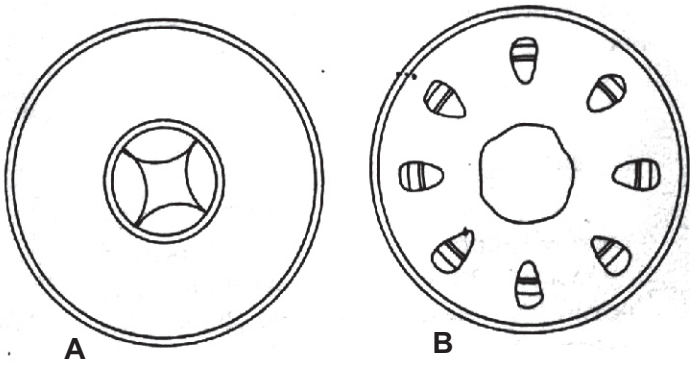
5. The diagram below shows a longitudinal section of some collenchyma cells in a young stem of a plant.



(a) Draw the cells as they would appear in the transverse section along the dotted line X Y. Your drawing must be to the same scale.

(b) (i) State one region in a stem where collenchyma is found.
(ii) Give one feature shown in the diagram that is characteristic of collenchyma.
(iii) Explain how the structure of collenchyma cells enables them to carry out their function in the young stem of a plant.

6. Diagrams A and B represent transverse sections from the stem and root of a flowering plant showing the distribution of the main tissue types (not to scale).



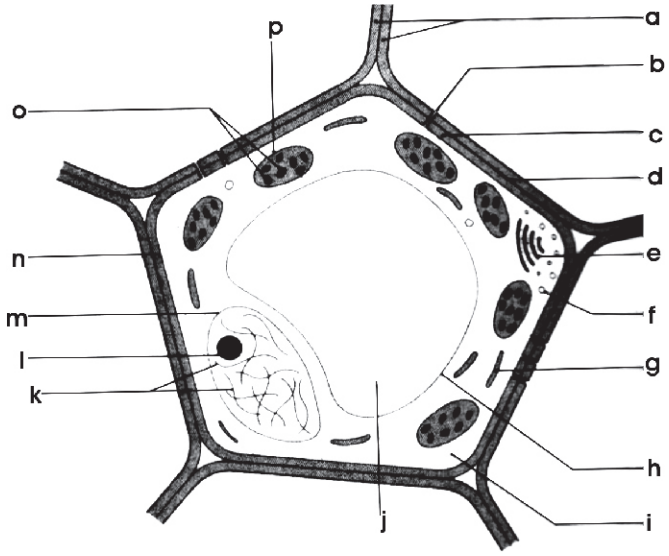
(i) Which diagram (A or B) is the root section? Explain your choice.

(ii) Using clear label lines and the letters give below, indicate on either diagram (A or B) the tissue most involved with each of the following activities.

upward transport of water	W
transport of sugars	S
cell division	D

(iii) The tissue that transports water upwards can readily be differentially stained. Which substance in the tissue is responsible for this effect?

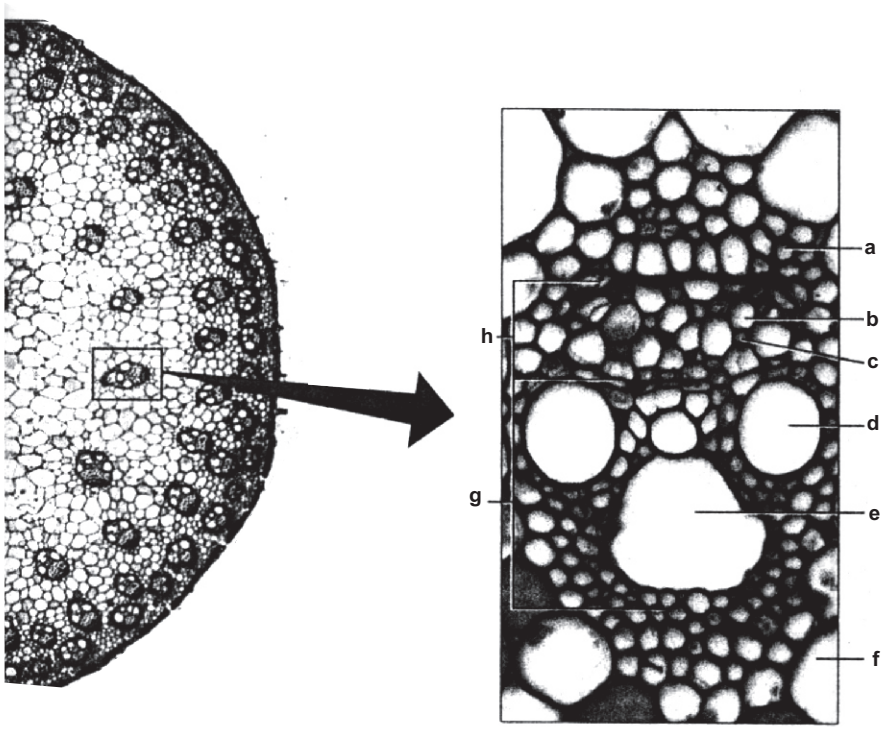
7. (a) Use the diagram showing the enlarged microscopic structure of a plant cell and filled the gap from a - p



(b) State briefly the functions of the following organelles

(i) Nucleus
(ii) Large central vacuole
(iii) Primary cell wall
(iv) Chloroplast

8. Use the diagram showing a portion of a single vascular bundle in cross section of a monocot stem. Label the parts a - h and state also the functions each of the following parts.
   (i) Xylem vessel
   (ii) Phloem vessel.

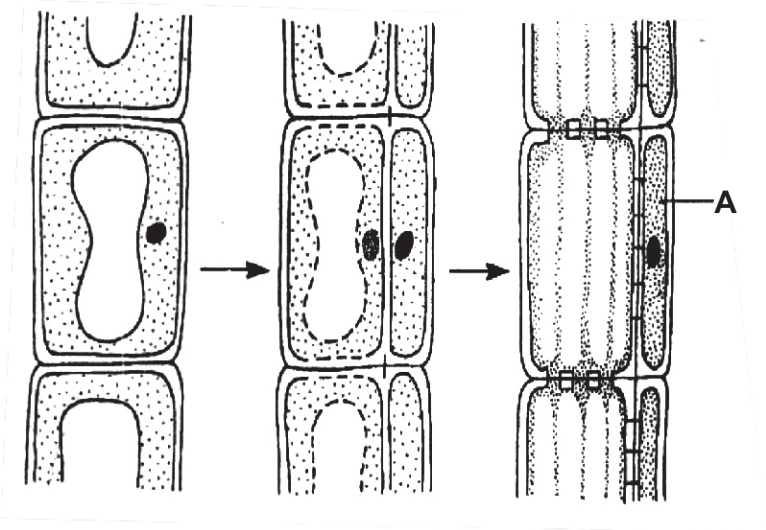


9. The diagram below represents stages in cell differentiation leading to the formation of phloem tissue in a woody stem.

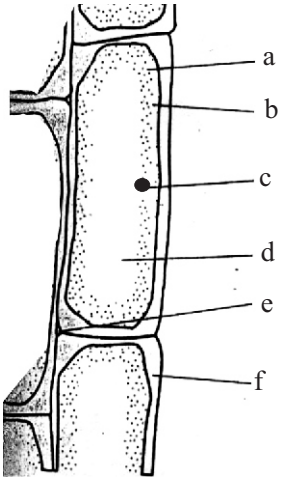
(i) State three changes, illustrated by the diagrams, which occur during the formation of phloem tissue.

(ii) (a) Name cell A

(b) Cell A is found to have many mitochondria. How is this feature related to the function of the cell?

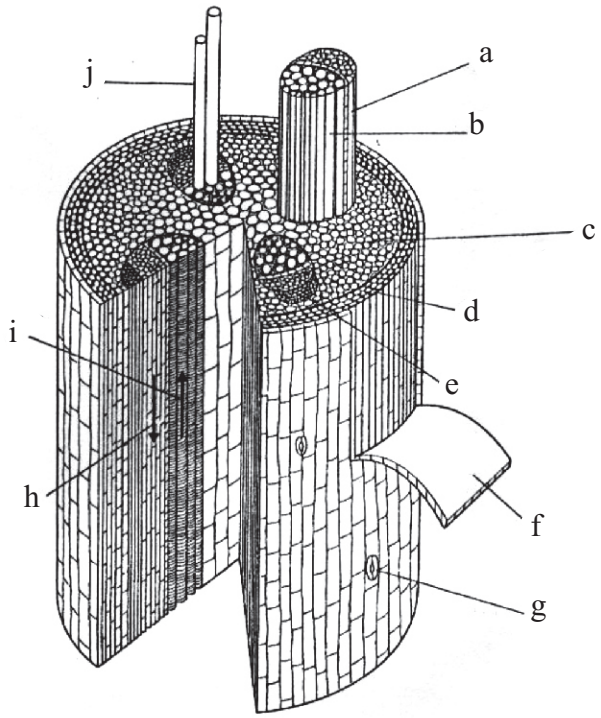


10. (a) Label the parts of collenchyma tissue as indicated below.



(b) (i) Summarize the functions of collenchyma tissue.

(ii) The diagram below shows a cross section of a stem with vascular bundle, label all the parts as indicated below.



(c) (i) State the functions of the following tissues: (a) xylem (b) phloem

. (ii) Defined the term permanent tissues

(iii) Name any four simple tissues found in plant.

APPENDIX FIVE
CONCEPT MAPPING

Concept mapping is a process of organising student's knowledge to increase their understanding and to help them learn. A concept map is a diagram that shows the organisation of ideas and the relationship among concepts in a particular subject area. The structure of a concept map is an organised cluster of concept, enclosed in rectangular boxes and connected with lines that explicitly state the relationships among the concepts. The function of a concept map is to help students structure their understanding of a topic and create personal meaning. The value of a concept map arises from the process of thinking and evaluating what students must do in order to create the map.

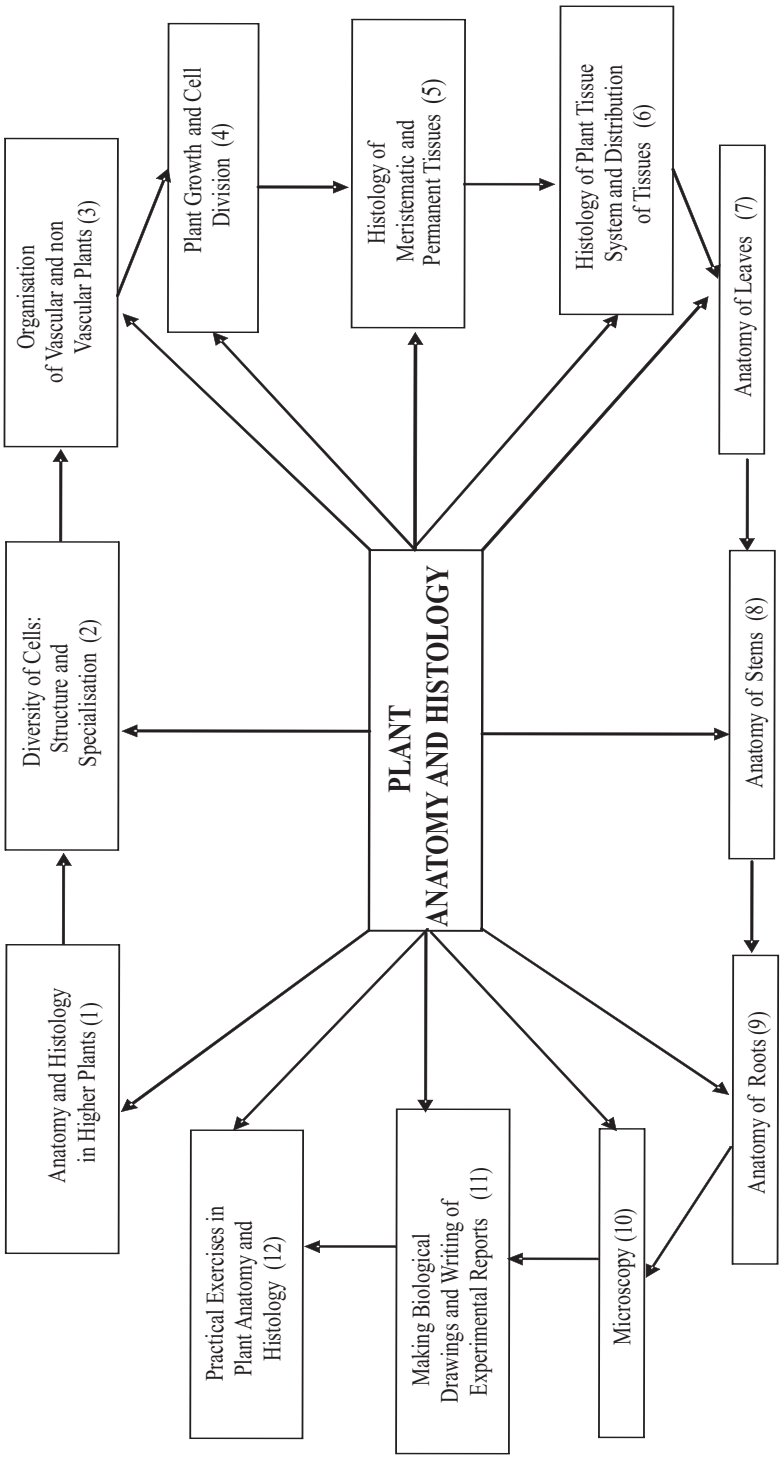
Plant anatomy is a rich and diverse course, filled with information and terminology that are necessary to understand the concepts and principles of plant internal structure and functions. Students often focus their attention on memorising bits of information, while missing how the pieces fit into the "big picture". A student must assimilate these details into broader concepts that are then related to other concepts, groups of concept and organising principles. Plant Anatomy and Histology as illustrated in the concept map in sketch 1, helps the students by regularly pointing out the topics that run through: (i) anatomy and histology in higher plants (ii) diversity of cells: structure and specialisation (iii) organisation of vascular and non vascular plants (iv) plant growth and cell division (v) histology of meristematic and permanent tissues (vi) histology of plant tissue system and distribution of tissues (vii) anatomy of leaves (viii) anatomy of stems (ix) anatomy of roots (x) microscopy (xi) making biological drawings and writing experimental reports and (xii) practical exercise in plant anatomy and histology.

Every chapter of this book has a set of key ideas or principles that are supported by examples and explanations. A student must recognise how these ideas are organised and develop a personal conceptual framework that can house the details of that chapter. Sketching a concept map will help create such a structure. To develop a concept map for a particular area, students must first identify the most important ideas or concepts. That process alone will help students sort out details from the organising principles. Then students evaluate the relative importance of these key

concepts (those that are most inclusive, those that are subordinate to other concepts); arrange the concepts in a meaningful cluster; and label the connections or relationship among the concepts.

A concept map is an individual picture of the understanding you had developed at the time you made the map. Meanings change and grow as you gain more knowledge and experience in an area. You develop a richer picture; you can make more connections among concepts and relate ideas in a more meaningful way. Knowledge is not static; it grows. As your understanding of an area develops, your concept map will evolve sometimes becoming more simplified and streamlined, sometime becoming more complex and interrelated.

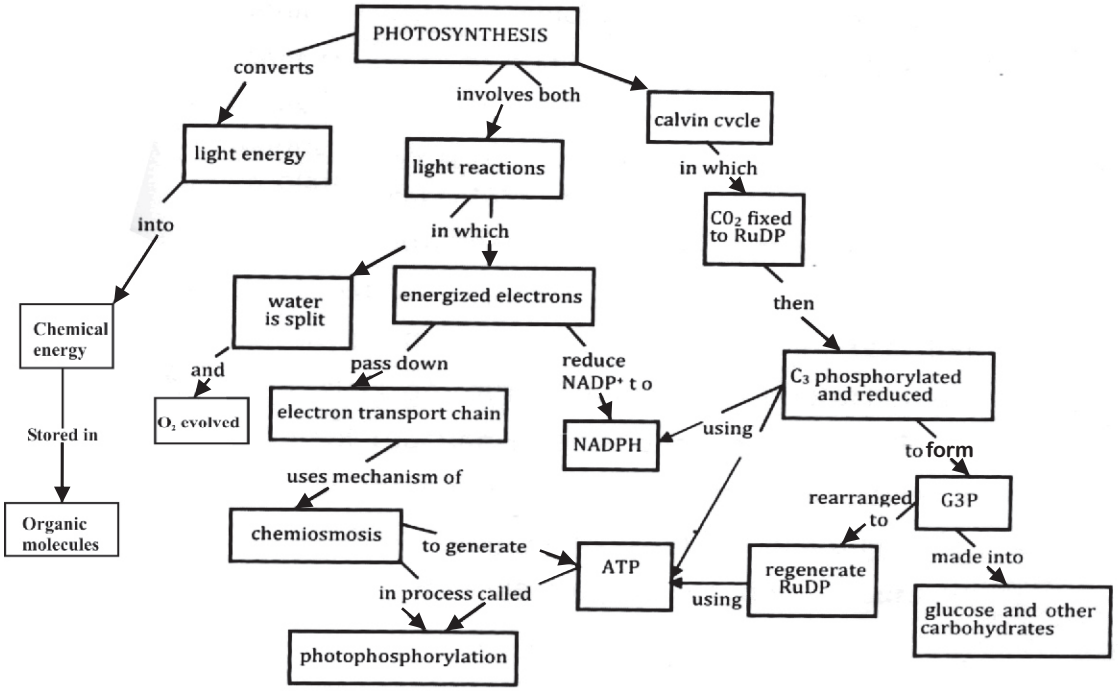
Concept maps are context-dependent. The same group of concepts can be organised in several ways, depending on the focus of the map as shown in sketch 1. The following example show similar clusters of concepts from Plant Anatomy and Histology on themes in the study of structure and development of tissues in plants.



Sketch (1): Showing Concept Mapping in Anatomy and Histology of Plant Tissues

Notice how the organisation of concepts changes depending on whether you are looking at an overview of plant anatomy or at one of the specific topics. Read through the concept mapping of plant anatomy and histology in sketch 1. You can then read through the connections that are drawn within the concept map. Recognise that these maps provide one way of structuring the ideas of this text. There is no one "right" or "wrong" concept map; they are individual representations of understanding. Maps may, however, be more or less accurate or valid, and sharing and talking through concept maps is a good way to assess your understanding.

Remember, the real value in concept mapping is in the process, in the weighting and relating and organising of concepts that each individual must do to develop a personal and meaningful understanding of this fascinating subject of plant anatomy and histology.



Sketch (2): Showing concept mapping in photosynthesis (Taylor 2002)

When students study or want to communicate facts and ideas, students may find it helpful to organise information visually as in sketch 2 showing concept mapping in photosynthesis. Concept maps can help students organise a broad topic having many subtopics. A concept map begins with a main idea and shows how it can be broken down into specific topics. It makes the ideas easier to understand by presenting their relationships visually. Students construct a concept map by placing the concept words (usually nouns) in rectangles and connecting the rectangles with linking words as illustrated in sketch 2. The most general concept usually is placed at the top of the map or in the centre. The content of the other rectangles become more specific as students move away from the main concept. The linking words, which describe the relationship between the linked concepts, are written on a line between two rectangles. If students follow any string of concepts and linking words down through a map, they should sound approximately like a sentence. Some concept maps may also include linking words that connect a concept in one branch to another branch. Such connections, called cross-linkages, show more complex inter-relationships.

APPENDIX SIX
LABORATORY SAFETY

The laboratory activities in this text will give you the opportunity to work directly with the different specimens and chemicals you are studying. To make the laboratory a safe place to work in, it is important that you follow a few basic safety rules and procedures. Before you begin working in any laboratory you should locate the exit and safety equipment, some of which are highlighted below. Be sure you understand under what conditions this equipment should be used.

Safety shower: Find out if your room has a safety shower. The shower is to be used in case you spill an acid or other corrosive substance on yourself.

Safety goggles: Protective eyewear should be worn at all times in the laboratory. It is important that you protect your eyes from chemicals or solid materials that might splatter or explode and cause injury.

First aid kit: Know the location of the first aid kit in your laboratory. The teacher or school nurse should administer any first aid and that is needed. Any injury should be reported to the teacher immediately.

Safety blanket: Locate the safety blanket in your room. Should any part of a students' clothing catch on fire, wrap the student in the safety blanket and roll him or her on the ground to put out the flames.

General Safety Rules:

1. Report any accident to your teacher at once.
2. Do only those laboratory activities assigned by your teacher.

3. Read through each laboratory rules completely before you begin work. Follow the instructions carefully.
4. Tie long hair back to keep it away from the work area.
5. Do not eat in the laboratory. Be sure to wash your hands before and after each activity.
6. When you complete an activity, clean up your work area and return all equipment to its proper place.

Specific Safety Rules

Chemicals: Use only those chemicals listed for the activity and keep containers closed when not in use. Try to avoid direct contact with any chemical and clean up spills immediately. Use tap water to rinse off any spilled chemicals. Dispose of each chemical as directed by your teacher. To prevent contamination, chemicals should not be returned to their original containers.

Glassware: When heating substances in glass containers remember that hot glassware may appear cool. Allow time for the container to cool before handling. If you should break a piece of glassware, use a broom, brush or a handful of wet paper towels to clean up any broken pieces. Dispose of the pieces in the proper container.

Heating materials: Always have your work area clean and keep extra materials such as chemicals or textbooks away from the flame. When heating substances in a test tube or other container do not look directly into the container. Be sure the opening of the container is pointing away from you and other people. Turn off the Bunsen burner when you leave your work area. Never leave a lit burner unattended.

Dissections: Handle the sharp scalpels and other instruments with extreme care. Always cut in a direction away from your body. A biology laboratory can be an interesting place to learn about science but you should remember that it is a place to work. Review and follow these rules and procedures to keep your laboratory a safe place.

APPENDIX SEVEN
THE METRIC SYSTEM

The metric system of measurement is used by scientists throughout the world. It is based on units of ten. Each unit is ten times larger or ten times smaller than the next unit. The most commonly used units of the metric system are given below.

Commonly Used Metric Units

Length: The distance from one point to another

Meter (m) A meter is slightly longer than a yard.
1 meter = 1000 millimeters (mm)
1 meter = 100 centimeters (cm)
1000 meters = 1 kilometer (km)

Volume: The amount of space an object takes up

litre (L) A litre is slightly more than a quart
1 litre = 1000 millimeters (mL)

Mass: The amount of matter in an object

Gram (g) A paper clip has a mass equal to about one gram.
1000 grams = 1 kilogram (kg)

Temperature: The measure of hotness or coldness

degrees 0^0C = freezing point of water
Celsius (^0C) 100^0C = boiling point of water

Metric English Equivalents

2.5 centimetres (cm) = 1 inch (in.)
1 metre (m) = 39.37 inches (in.)
1 kilometre (km) = 0.62 miles (mi)
1 litre (L) = 1.06 quart (qt)
236 milliliters (mL) = 1 cup (c)
1 kilogram (kg) = 2.2 pounds (1b)
28.3 grams (g) = 1 ounce (oz)
$^0C = 5/9 \times (^0F-32)$

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(ii) Did you come across inaccuracies in facts/misleading information in the text? Please specify the chapters, topics and the page numbers.

(iii) Is there any figure/figure(s) that are misrepresented in the text? Please specify the chapter, topic(s) and figure numbers.

(iv) Did you notice any topics/subtopics that do not really explain the content highlighted therein? Please list and comment.

(v) Are the chapter arrangement in this text appropriate? State your suggestion(s) if any.

(vi) Are the chapter/topic(s) related to the chapter(s) objectives? Do you find any disparity? Please comment freely.

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(viii) Do you find the summary, evaluation and tutorial questions useful/necessary in this kind of text? Please state your view(s).

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(x) Give the title of three books you have read (including the author's name and year of publication) on the same subject matter that is better than the present text in order of preference. Please specify in terms of quality in all aspects.

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