

Anatomy of Flowering Plants — Assignment 2

Class 11 Biology · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Meristematic Tissues

1. Distinguish between apical and lateral meristems.
2. State two characteristics of meristematic cells.
3. Describe the types of meristematic tissues based on position.

Simple Permanent Tissues

1. Distinguish between parenchyma and sclerenchyma.
2. State the functions of the epidermis.
3. Describe the structure and functions of simple permanent tissues.

Complex Permanent Tissues — Xylem and Phloem

1. Distinguish between xylem and phloem.
2. Name the four elements of phloem.
3. Describe the elements of xylem and their functions.

Tissue Systems and Dicot vs Monocot Roots

1. Distinguish between dicot and monocot roots.
2. What are radial vascular bundles?
3. Describe the internal structure of a dicot root.

Dicot vs Monocot Stem Anatomy

1. Distinguish between dicot and monocot stems.
2. What is a conjoint vascular bundle?
3. Describe the internal structure of a monocot stem.

Leaf Anatomy — Dorsiventral vs Isobilateral

1. Distinguish between palisade and spongy mesophyll.
2. Distinguish between dorsiventral and isobilateral leaves.
3. Describe the internal structure of a dorsiventral leaf.

Secondary Growth

1. Distinguish between vascular cambium and cork cambium.
2. What is the role of the periderm?
3. Describe the process of secondary growth in a dicot stem.

Part B — Integrated problems (multi-topic)

1. Classify meristems on the basis of position and origin, giving the function of each.
2. Compare parenchyma, collenchyma and sclerenchyma with respect to wall thickness, living/dead state and function.
3. Distinguish xylem and phloem with respect to their conducting elements and the direction of transport.
4. Compare the internal structure of a dicot root and a monocot root on the basis of vascular bundles and pith.
5. Explain how a dorsiventral leaf differs from an isobilateral leaf in mesophyll and stomatal distribution.
6. Describe the sequence of events in secondary growth of a dicot stem, naming the cambia involved.

Answer Key

Meristematic Tissues

Apical meristem lies at the root and shoot tips and causes primary growth (increase in length); lateral meristem (cambium) lies in the mature regions and causes secondary growth (increase in girth). Meristematic cells are thin-walled, living, densely protoplasmic, without vacuoles and divide actively. Based on position: apical, lateral and intercalary meristems.

Simple Permanent Tissues

Parenchyma is living and thin-walled (storage, photosynthesis); sclerenchyma is dead with thick lignified walls (mechanical support). The epidermis is the outermost layer; it protects the plant, has stomata for gaseous exchange and is covered by a cuticle to reduce water loss.

Complex Permanent Tissues — Xylem and Phloem

Xylem conducts water and minerals upward and has tracheids, vessels, xylem parenchyma and xylem fibres (mostly dead); phloem conducts food in both directions and has sieve tubes, companion cells, phloem parenchyma and phloem fibres. The four elements of phloem are sieve tubes, companion cells, phloem parenchyma and phloem fibres. Xylem elements: tracheids and vessels (conduction), xylem parenchyma (storage, living) and xylem fibres (support).

Tissue Systems and Dicot vs Monocot Roots

Dicot root: radial vascular bundles, 2–4 xylem bundles (diarch to tetrarch) and a small/absent pith. Monocot root: radial bundles but many (polyarch, more than 6) xylem bundles and a large, well-developed pith. Radial vascular bundles have xylem and phloem on different radii. Dicot root structure (from outside in): epiblema, cortex, endodermis, pericycle, radial vascular bundles and pith.

Dicot vs Monocot Stem Anatomy

Dicot stem: vascular bundles in a ring (eustele), collenchymatous hypodermis and a distinct pith. Monocot stem: scattered vascular bundles (atactostele), sclerenchymatous hypodermis and no distinct pith. A conjoint vascular bundle has xylem and phloem on the same radius. Monocot stem structure: epidermis, hypodermis (sclerenchyma), ground tissue with scattered bundles (each surrounded by a sclerenchymatous bundle sheath).

Leaf Anatomy — Dorsiventral vs Isobilateral

Palisade mesophyll: columnar cells rich in chloroplasts, near the upper surface; spongy mesophyll: loosely arranged cells with air spaces, below. Dorsiventral leaf: distinct upper and lower surfaces, both mesophylls, stomata mainly on

the lower surface. Isobilateral leaf: similar surfaces, palisade-like mesophyll on both sides, stomata on both surfaces (monocots). Dorsiventral leaf structure: epidermis (upper and lower), mesophyll (palisade + spongy) and vascular bundles (veins).

Secondary Growth

Vascular cambium forms the secondary xylem inward and secondary phloem outward; cork cambium (in the cortex) forms cork (phellem) outward and secondary cortex (phelloderm) inward. The periderm (cork + cork cambium + phelloderm) replaces the epidermis as a protective layer. Secondary growth in a dicot stem: activity of vascular cambium and cork cambium increases girth, forms annual rings and the periderm.

Integrated problems

1: Apical (primary growth), lateral (secondary growth) and intercalary (elongation at the base of internodes); by origin — primary and secondary meristems. 2: Parenchyma — thin-walled, living, storage/photosynthesis; collenchyma — thickened corners, living, flexibility; sclerenchyma — thick lignified, dead, support. 3: Xylem (tracheids, vessels) transports water upward; phloem (sieve tubes, companion cells) transports food both ways. 4: Dicot root — 2–4 radial xylem bundles, small pith; monocot root — many (polyarch) bundles, large pith. 5: Dorsiventral — palisade + spongy mesophyll, stomata mainly lower (dicots); isobilateral — palisade-like mesophyll both sides, stomata both surfaces (monocots). 6: Vascular cambium → secondary xylem/phloem; cork cambium → cork/phelloderm; together they form the periderm and annual rings.