

Morphology 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

Root System

1. Distinguish between tap root and fibrous root systems.
2. What are adventitious roots? Give two examples.
3. Explain the modifications of roots for storage and support.

Stem

1. State two functions of the stem.
2. Distinguish between a stem and a root.
3. Explain the aerial modifications of stems with examples.

Leaf

1. Distinguish between reticulate and parallel venation.
2. What is a compound leaf?
3. Explain the modifications of leaves for different functions.

The Flower

1. Distinguish between a complete and an incomplete flower.
2. What is the difference between aestivation and placentation?
3. Explain the types of placentation with examples.

Fruit and Seed

1. Distinguish between a true fruit and a false fruit.
2. What is the difference between monocot and dicot seeds?
3. Describe the structure of a typical seed.

Major Families — Fabaceae, Solanaceae, Liliaceae

1. Give the floral formula of Fabaceae.
2. State two features of Liliaceae.
3. Describe the floral characters of the family Fabaceae.

Part B — Integrated problems (multi-topic)

1. Describe three modifications of roots for storage and three for support, with the plant in which each occurs.
2. Compare the tap root and fibrous root systems with respect to origin and examples.
3. Distinguish between a stem and a root on the basis of at least four characters.
4. Draw and explain the floral formula and floral diagram of the family Fabaceae.
5. Explain the types of placentation with a suitable example of each.
6. Compare the three families Fabaceae, Solanaceae and Liliaceae with respect to fruit and economic importance.

Answer Key

Root System

Tap root: develops from the radicle, one main root with lateral branches (e.g. pea, mustard). Fibrous root: a cluster of roots of equal size from the base of the stem (e.g. grass, wheat). Adventitious roots arise from parts other than the radicle — e.g. prop roots of banyan and stilt roots of sugarcane for support; tuberous roots of sweet potato for storage. Root regions: root cap, region of meristematic activity, region of elongation and region of maturation (with root hairs).

Stem

Two functions: it supports the branches, leaves, flowers and fruits, and conducts water and minerals (and food). Stem vs root: stem bears nodes and internodes, has buds, is green/photosynthetic when young and develops from the plumule; root bears no nodes, has no buds, is non-green and develops from the radicle. Aerial stem modifications: tendrils (pea) for climbing, thorns (Citrus) for protection, and phylloclades (Opuntia) for photosynthesis.

Leaf

Reticulate venation: veins form a network, typical of dicots. Parallel venation: veins run parallel, typical of monocots. A compound leaf has the lamina divided into leaflets on a common petiole (e.g. neem — pinnately compound; silk cotton — palmately compound). Leaf modifications: tendrils (pea) for climbing, spines (cactus) for protection, storage (onion) and insect-trapping (pitcher plant, Venus flytrap).

The Flower

A complete flower has all four whorls (calyx, corolla, androecium, gynoecium); an incomplete flower lacks one or more whorls. Aestivation is the arrangement of sepals/petals in the bud; placentation is the arrangement of ovules within the ovary. Placentation types: marginal (pea), axile (China rose, tomato), parietal (mustard, argemone), free central (Dianthus) and basal (sunflower).

Fruit and Seed

A true fruit develops only from the ovary (e.g. mango); a false fruit develops from the ovary and other floral parts such as the thalamus (e.g. apple, cashew). Monocot seeds have one cotyledon (e.g. maize) and dicot seeds have two (e.g. bean). A typical seed has a seed coat (testa + tegmen), an embryo (radicle + plumule) and reserve food in the endosperm or cotyledons.

Major Families — Fabaceae, Solanaceae, Liliaceae

Fabaceae: $\% \text{ } \text{K}(5) \text{ } \text{C}1+2+(2) \text{ } \text{A}(9)+1 \text{ } \text{G}1$; fruit is a legume; e.g. pea, gram, soya bean; rich in proteins. Liliaceae: usually a superior ovary, a capsule or berry fruit; e.g. onion, garlic, tulip. Fabaceae floral characters: papilionaceous corolla, diadelphous stamens $(9)+1$, marginal placentation, legume fruit.

Integrated problems

1: Storage — fusiform (radish), conical (carrot), tuberous (sweet potato); support — prop roots (banyan), stilt roots (sugarcane), buttress roots (bombax). 2: Tap root from the radicle with lateral branches (pea, mustard); fibrous root a cluster of equal roots (grass, wheat). 3: Stem — nodes/internodes, buds, develops from plumule, usually green; root — no nodes/buds, develops from radicle, non-green. 4: Fabaceae floral formula $\frac{\text{K}(5) \text{C}1+2+(2) \text{A}(9)+1 \text{G}1}{\text{ }}$; floral diagram shows a papilionaceous flower with a standard, two wings, two keel petals, diadelphous stamens and marginal placentation. 5: Marginal (pea), axile (China rose), parietal (mustard), free central (Dianthus), basal (sunflower). 6: Fabaceae — legume, proteins/pulses; Solanaceae — berry/capsule, vegetables/medicines (tomato, belladonna); Liliaceae — capsule/berry, ornamental and vegetable (onion, tulip).