Unit 1 · Plant Anatomy

ANSWER KEY · FOR TEACHERS

Full marks 32

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. meristem
2. collenchyma
3. lignin
4. companion cell
5. Casparian strip
6. bulliform
7. phellogen
8. tyloses

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. epiblema
2. cortex
3. endodermis
4. pericycle
5. protoxylem
6. conjunctive tissue

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **b.** towards the periphery, outside the metaxylem — K · 1

Exarch: protoxylem towards the **ex**terior (periphery), as in roots. The other options are endarch, mesarch and centrarch.

ii. **d.** xylem — U · 1

Xylem is a complex tissue of four kinds of cell (tracheids, vessels, parenchyma, fibers), so it is heterogeneous. The others are each one kind of cell.

iii. **b.** tyloses — U · 1

Tyloses, outgrowths of xylem parenchyma that bulge into vessels through their pits, block them in heartwood. Callose blocks sieve plates of phloem, not xylem; suberin and lignin strengthen walls.

iv. **b.** a monocot root: polyarch, with a large pith — A · 1

Radial bundles (xylem and phloem alternating) say **root**, not stem. More than six xylem strands (**polyarch**) round a **large pith** say **monocot**. A dicot root has two to six strands and little or no pith.

v. **c.** conjoint, collateral and closed; in a maize stem — A · 1

Xylem and phloem together on one radius make it **conjoint** and **collateral**; with no cambium it is **closed**. That is the bundle of a **monocot** stem, such as maize. A sunflower's bundle has a cambium strip (open); a pumpkin's has phloem on both sides (bicollateral); a root's strands lie on different radii (radial).

4 Short answers

a. MARKING SCHEME — K · 2

- ✓ A permanent tissue of several kinds of cell working together for one function.
- ✓ Xylem and phloem.

b. MARKING SCHEME — U · 2

- ✓ One correct difference (e.g. fiber long and narrow with pointed ends, sclereid short with blunt ends).
- ✓ A second (e.g. fibers in strands for strength; sclereids, wall thicker and lumen tiny, for hardness).

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c. MARKING SCHEME A · 2

✓ The pine's core.

✓ Seasons make spring and autumn wood in the pine; a climate the same all year gives uniform wood with no clear rings.

d. MARKING SCHEME U · 3

✓ A band of suberin round the radial and transverse walls of the endodermis.

✓ Water must pass through the living membranes, so the endodermis controls what enters the stele.

✓ Passage cells: thin-walled endodermis cells opposite the protoxylem that let water through.

5 Long answers

a. ANSWER U · 4

Any four:

Dicot stem	Monocot stem
hypodermis of collenchyma	hypodermis of sclerenchyma
ground tissue divided into cortex, endodermis, pericycle, medullary rays and pith	one undivided ground tissue
bundles in a ring (eustele), of about equal size	bundles scattered (atactostele), small at the edge, large in the middle
bundles conjoint, collateral and **open** (a cambium)	conjoint, collateral and **closed** (no cambium)
bundle caps; no bundle sheath	a sclerenchyma bundle sheath round each bundle
many xylem vessels in radial rows	few vessels in a V or Y, with a water cavity
phloem parenchyma present	phloem parenchyma absent
multicellular hairs	usually no hairs
secondary growth takes place	no secondary growth

MARKING SCHEME

✓ A first correct difference.

✓ A second correct difference.

✓ A third correct difference.

✓ A fourth correct difference.

b. ANSWER A · 4

The **periderm** is the protective tissue made by the **cork cambium** during secondary growth; it replaces the torn epidermis.

- **Phellem (cork)**, outside: **dead**, closely packed, box-shaped cells with **suberin** in their walls; waterproof, it protects against water loss, infection and injury.
- **Phellogen (cork cambium)**: a meristem formed from the outer cortex; it makes cork outward and phelloderm inward.
- **Phelloderm (secondary cortex)**, inside: a few layers of **living** parenchyma that store food.

At a **lenticel** the phellogen makes loose, rounded **complementary cells** with **air spaces** instead of cork, so the tissues inside can exchange gases with the air through the airtight bark.

MARKING SCHEME

✓ The protective tissue made by the cork cambium in secondary growth, replacing the epidermis.

✓ Phellem: dead, suberized cork outside that protects.

✓ Phellogen makes cork outward and phelloderm (living, stores food) inward.

✓ A lenticel has loose complementary cells with air spaces for gas exchange, not cork.

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6 Think

ANSWER HA · 3

Bamboo is a monocot: its bundles are closed, with **no vascular cambium**, so it has **no secondary growth** and makes no wood or rings.
Chir pine grows where winters are cold: its cambium makes wide-celled **spring wood** and dense **autumn wood**, then stops, so each year's ring has a **sharp boundary**.
Sal in the Tarai grows **most of the year with no sharp break**, so the change from one year's wood to the next is slight and its rings are hard to see.

MARKING SCHEME

- ✓ Bamboo: no vascular cambium, so no secondary growth or rings.
- ✓ Pine: a cold season makes spring and autumn wood, a sharp ring each year.
- ✓ Sal: growth with no sharp seasonal break, so the rings are faint.

7 Activity: Lenticels and cork

(not marked)

WHAT STUDENTS SHOULD FIND

The twig shows tiny raised **pale dots or short lines**: lenticels. The potato's skin, a thin periderm, has small **pale spots**. After a week in the damp, the lenticels swell into **white bumps** as their complementary cells grow. Lenticels let the living tissues under the airtight cork **exchange gases** with the air.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	10	11	8	3	**32**

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