Unit 8 · Pteridophyta

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. cryptogams
2. frond
3. ramenta
4. circinate
5. sori
6. indusium
7. prothallus
8. heterosporous

Each carries 0.5 mark. K · 4

2 Label the diagram

1. circinate young leaf
2. rhizome
3. ramenta (scales)
4. sori
5. rachis
6. petiole

Each carries 0.5 mark. K · 3

3 Multiple choice

i. **c.** the neck canal cell — K · 1

The archegonium's neck holds a single **neck canal cell with two nuclei** (binucleate). The egg, the venter canal cell and the spore mother cells each have one nucleus.

ii. **c.** 48 to 64 — K · 1

Its **12 to 16** spore mother cells each divide by meiosis into four spores: **48 to 64** spores.

iii. **b.** the prothallus — U · 1

The **prothallus** grows from a haploid spore, so it is haploid. The frond (part of the sporophyte), the spore mother cells (before meiosis) and the zygote are all diploid.

iv. **b.** malic acid in the mucilage oozing from its neck — U · 1

The neck canal cell and venter canal cell break down into **mucilage containing malic acid**. The antherozoids swim through a film of water towards it: **chemotaxis**.

v. **d.** *Azolla* — A · 1

The water fern *Azolla* has the nitrogen-fixing cyanobacterium *Anabaena azollae* living in cavities in its leaves, so it adds nitrogen to the field.

4 Short answers

a. MARKING SCHEME — K · 2

- ✓ Vascular: they have xylem and phloem (true roots, stems and leaves).
- ✓ Cryptogams: no flowers or seeds; they reproduce by spores.

b. MARKING SCHEME — U · 2

- ✓ Homosporous: one kind of spore, e.g. *Dryopteris*.
- ✓ Heterosporous: microspores and megaspores, e.g. *Selaginella*.

c. MARKING SCHEME — U · 2

- ✓ Prothallus small and short-lived; *Marchantia*'s gametophyte the large, long-lived main plant.
- ✓ Prothallus monoecious; *Marchantia* dioecious (separate male and female plants).

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d. MARKING SCHEME A · 3

- ✓ Water evaporates from the annulus cells in dry air.
- ✓ The annulus straightens and tears the capsule open at the stomium.
- ✓ It springs back suddenly and flings the spores out.

5 Long answer

a. ANSWER U · 4

The **sporophyte** (2n) is the fern plant. Spore mother cells in its sporangia divide by **meiosis** into haploid **spores**.
A spore germinates on damp soil into the **gametophyte**, the **prothallus** (n), which bears antheridia and archegonia.
An antherozoid swims through water to the egg; **fertilization** gives the diploid **zygote**, which grows into a new sporophyte, feeding on the prothallus until its root and leaf make it independent.
The large, long-lived, independent **sporophyte is dominant**; in bryophytes the main plant is the gametophyte, and the sporophyte depends on it.

MARKING SCHEME

- ✓ The sporophyte (2n) makes haploid spores by meiosis.
- ✓ A spore grows into the prothallus (n), the gametophyte, with the sex organs.
- ✓ Fertilization in water gives the zygote, which grows into the new sporophyte.
- ✓ The sporophyte is dominant in ferns; the gametophyte is dominant in bryophytes.

b. ANSWER A · 4

Structure: the prothallus is haploid, small (about 5 mm), flat, green and **heart-shaped**, with an **apical notch** at its broad front end and **rhizoids** on its lower surface near the pointed back end.
It is **monoecious**: archegonia near the notch, antheridia among the rhizoids, both on the lower surface.
Function: it is independent: its chlorophyll makes its food and its rhizoids fix it and absorb water and minerals.
It makes the gametes, fertilization happens on it in a film of water, and it feeds the young sporophyte until that is independent.

MARKING SCHEME

- ✓ Small, flat, green, heart-shaped, haploid, with an apical notch and rhizoids.
- ✓ Monoecious: archegonia near the notch, antheridia among the rhizoids.
- ✓ Independent: makes its own food, rhizoids absorb water and minerals.
- ✓ Bears the gametes, the site of fertilization; feeds the young sporophyte.

6 Think

ANSWER HA · 3

New fern plants come from the **prothallus**, a tiny, thin gametophyte that needs a **damp, shady** place to grow from a spore and to stay alive.
Fertilization needs water: the antherozoids must swim through a film of dew or rain to the egg in the archegonium.
In a dry, sunny room the spores dry out or the prothalli die, and there is no water film, so no zygote and no new sporophyte forms; on the damp bank both needs are met.

MARKING SCHEME

- ✓ The new plant comes from a prothallus, which needs damp, shady conditions.
- ✓ Antherozoids need a film of water to swim to the egg.
- ✓ A dry, sunny room gives neither, so no zygote or young fern forms.

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7 Activity: Look under a fern leaf

(not marked)

WHAT STUDENTS SHOULD FIND

The young leaves are **circinate**, coiled from the tip like a violin's scroll (niuro). The petiole and rhizome carry brown, papery **ramenta**. Each brown dot is a **sorus**, in two rows on each pinna, one each side of the midrib, covered by a kidney-shaped **indusium** that shrivels when the sporangia are ripe. Under the lamp the drying sporangia throw out their **spores**: a fine brown dust on the paper. The prothalli grow on damp soil, damp bricks and flower pots in the shade, under the ferns.

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

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