Unit 6 · Algae

ANSWER KEY · FOR TEACHERS

Full marks 35

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. phycology
2. thallus
3. phycoerythrin
4. fucoxanthin
5. pyrenoids
6. scalariform
7. azygospore
8. agar

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. mucilage
2. nucleus
3. septum
4. pyrenoid
5. chloroplast
6. cytoplasmic strand

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **d.** phycoerythrin — K · 1

Phycoerythrin, a red phycobilin, masks the chlorophyll of red algae. Chlorophyll *b* isn't found in them at all.

ii. **a.** chlorophyll *a* and chlorophyll *b* — K · 1

Green algae have **chlorophyll** *a* **and** *b*, with carotenes and xanthophylls, exactly the pigments of land plants, and store starch as they do: two of the clues that land plants evolved from green algae.

iii. **c.** Phaeophyceae — U · 1

Fucoxanthin, **laminarin** and **mannitol** mark the **brown algae** (Phaeophyceae). Green algae store starch; red algae floridean starch and have phycoerythrin.

iv. **b.** because their gametes have all moved through the tubes into the cells of the other filament — U · 1

In scalariform conjugation one filament acts as the "male": each of its gametes moves through a conjugation tube into the facing cell of the other filament. So its cells are left **empty**, and the **zygospores** are all in the other filament.

v. **c.** the zygospore — A · 1

The filament, its gametes and its asexual spores are all haploid. Only the **zygospore** is diploid, and its nucleus divides by meiosis when it germinates.

4 Very short answers

a. MARKING SCHEME — K · 1

✓ F. E. Fritsch.

b. MARKING SCHEME — K · 1

✓ Floridean starch; laminarin and mannitol.

c. MARKING SCHEME — U · 1

✓ Algae grow on them, coated with mucilage.

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5 Short answers

a. MARKING SCHEME — U · 2

- ✓ Water absorbs red light near the surface; green and blue light go deepest.
- ✓ Phycoerythrin absorbs green and blue light and passes the energy to chlorophyll a.

b. MARKING SCHEME — U · 2

- ✓ Two correct differences.
- ✓ Two more correct differences.

c. MARKING SCHEME — A · 2

- ✓ Spirogyra.
- ✓ One other feature (nucleus suspended in the vacuole, pyrenoids, mucilage sheath).

d. MARKING SCHEME — U · 3

- ✓ Akinete: a whole cell thick-walled with food.
- ✓ Aplanospore: the protoplast walled inside the old wall.
- ✓ Azygospore: an unfused gamete walled alone.

6 Long answers

a. ANSWER — U · 4

Two filaments of **opposite strains** lie side by side in a common sheath of mucilage. Facing cells put out **papillae**, which touch; the walls between them are dissolved (by cytase), forming **conjugation tubes**: the filaments look like a **ladder**.
The protoplast of each cell rounds off as a gamete. The **male gamete** creeps through the tube into the female gametangium and fuses with the female gamete, forming a diploid **zygote**, which secretes a thick, three-layered wall: the **zygospore**. One filament is left empty.
On germination the diploid nucleus divides by **meiosis**; three of the four haploid nuclei degenerate. The outer wall bursts and a **germ tube** grows out and divides: the lower cell becomes a colorless **rhizoidal cell**, the upper one divides again and again into a **new filament**.

MARKING SCHEME

- ✓ Two filaments side by side; papillae; conjugation tubes like a ladder.
- ✓ Male gamete moves through the tube and fuses with the female: zygote.
- ✓ Thick-walled zygospore; one filament left empty.
- ✓ Meiosis, three nuclei degenerate; germ tube, rhizoidal cell and new filament.

b. ANSWER — A · 4

Sewage and fertilizer add **nitrate and phosphate**: the water becomes **eutrophic** (Phewa is hypereutrophic during the monsoon, when the rivers wash the most in). With warm, still, sunlit water, algae and cyanobacteria multiply into a dense **bloom**.
The bloom **shades** the plants below. When it dies, **bacteria decaying it use up the dissolved oxygen**, so fish and other animals suffocate; some blooms make **poisons**. A few bloom species crowd out the rest: **biodiversity** falls and the water smells and tastes bad.
Prevention, any two: treat sewage before it reaches the lake; use fertilizer carefully; keep strips of plants along the banks to catch runoff; keep phosphate out of detergents.

MARKING SCHEME

- ✓ Nutrients (nitrate, phosphate) from sewage and fertilizer: eutrophication.
- ✓ Algae multiply into a bloom in warm, still, sunlit water.
- ✓ Decay of the bloom uses up oxygen: fish die; poisons, lost biodiversity.
- ✓ Two sound ways to prevent it.

7 Think

ANSWER

"Algae" names a **way of life** (simple, photosynthetic, mostly aquatic thalli), not one line of descent: the **red algae** are a separate lineage, the **brown algae** are closer to the water molds and diatoms than to plants, and the "blue-green algae" are bacteria.
The **green algae** are closest to the land plants: they have the same pigments, **chlorophyll *a* and** *b*,

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store **starch**, and have **cellulose** walls, as land plants do (the red have phycoerythrin and floridean starch, the brown chlorophyll *c*, fucoxanthin and laminarin).

MARKING SCHEME

- ✓ Algae are a way of life, not one lineage (red separate, brown with water molds, blue-green are bacteria).
- ✓ Green algae are closest to land plants.
- ✓ Evidence: chlorophyll a and b, starch, cellulose walls.

8 Activity: Algae in a drop of pond water

(not marked)

WHAT STUDENTS SHOULD FIND

Long unbranched threads with spiral green ribbons in every cell: *Spirogyra*; threads with a band-shaped chloroplast round each cell: *Ulothrix*; tiny darting green cells with a cup-shaped chloroplast: *Chlamydomonas*; rolling green balls: *Volvox*; golden-brown boat-shaped cells with glassy walls: diatoms; blue-green threads with no chloroplasts: cyanobacteria such as *Oscillatoria*.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	11	14	7	3	**35**

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