



Unit 2 • Classification of Living Beings: plants

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. Whittaker
2. thallus
3. rhizoids
4. amphibians
5. sori
6. cones
7. ovary
8. cotyledons

K • 4

Each carries 0.5 mark.

2 Multiple choice

- i. c. eukaryotic cell, cell with cell wall, autotrophs

K • 1

Plants are eukaryotic, their cells have a cellulose wall, and they make their own food with chlorophyll (autotrophs). Option (iv) describes fungi; (ii) describes animals.

- ii. c. Tracheophyta

K • 1

Tracheophyta are the vascular plants. Spermatophyta (seed plants) have vascular tissue too, but they are only part of Tracheophyta: ferns have vascular tissue and no seeds.

- iii. c. it bears cones instead of flowers, and its seeds are naked, without fruit

U • 1

Gymnosperms bear cones instead of flowers, and their seeds are naked. Cycas has no needle leaves, and no gymnosperm has fruits.

- iv. c. xylem and phloem are found in the clubmoss

U • 1

The vascular tissue, xylem and phloem, is what puts the clubmoss in Tracheophyta and gives it true roots, stems and leaves. (Option iv is also true of the clubmoss, but it follows from having vascular tissue; the key difference is (iii).)

- v. d. paddy, banana, mango

A • 1

Paddy and banana are monocots, mango a dicot: all flowering plants. Pine and juniper are gymnosperms, fern a pteridophyte, and moss a bryophyte.

3 Label the diagram

- | | |
|--|--|
| 1. frond (leaf) | 5. gametophyte: the prothallus (about 5 mm across) |
| 2. leaflet (pinna) | 6. rhizoids |
| 3. roots | 7. fiddlehead: a young leaf, coiled |
| 4. sorus: a cluster of sporangia, full of spores | 8. rhizome: the stem, under the soil |

K • 4

Each carries 0.5 mark.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ Three: Algae, Bryophyta and Tracheophyta.

- b. MARKING SCHEME

K • 1

✓ A plant body not divided into root, stem and leaf.



- c. MARKING SCHEME U · 1
✓ The sporophyte.

5 Short answers

- a. MARKING SCHEME U · 2
✓ Any one difference, e.g. moss is a bryophyte with no vascular tissue; clubmoss is a pteridophyte (Tracheophyta) with xylem and phloem.
✓ Any second difference, e.g. moss has rhizoids and simple stem and leaves, clubmoss true root, stem and leaf; or in moss the gametophyte is dominant, in clubmoss the sporophyte.
- b. MARKING SCHEME U · 2
✓ A fruit develops from the ovary of a flower.
✓ Gymnosperms have cones, not flowers, and a cone has no ovary (the ovules lie open on its scales), so there is no fruit and the seeds are naked.
- c. MARKING SCHEME U · 2
✓ Riccia (a bryophyte) lives on land.
✓ But its male gametes must swim through water to reach the egg, so, like an amphibian, it needs water to complete its life cycle.
- d. MARKING SCHEME A · 2
✓ All three have a body divided into true root, stem and leaf, and vascular tissue (xylem and phloem): the features of Tracheophyta.
✓ Their differences (no seeds, naked seeds, seeds in fruit) only put them in different subdivisions: Pteridophyta, Gymnosperms and Angiosperms.

6 Long answers

- a. ANSWER U · 4
The green moss plant is the **gametophyte** (n): it makes male gametes in antheridia and an egg in an archegonium. After rain, a male gamete swims through a film of water to the egg and fuses with it: the zygote ($2n$). The zygote grows, on top of the female plant, into the **sporophyte**, a stalk with a capsule, which lives on the gametophyte. In the capsule, spore mother cells divide by meiosis into haploid spores, which the wind carries away. A spore that lands somewhere damp grows into a new green gametophyte. The two generations take turns; in a moss the **gametophyte** is dominant.
- MARKING SCHEME
- ✓ The green plant is the gametophyte; it makes gametes in antheridia (male) and an archegonium (egg).
 - ✓ The male gamete swims through water to the egg; fertilization gives a zygote.
 - ✓ The zygote grows into the sporophyte (stalk and capsule) on the gametophyte; its capsule makes spores (by meiosis).
 - ✓ Spores grow into new gametophytes; the gametophyte is dominant.



- i. Both are tracheophytes: true root, stem and leaf, vascular tissue, and both make seeds.
- ii. The orange bears flowers and its seeds are enclosed in a fruit; Cycas bears cones and its seeds are naked.
- iii. The orange is an angiosperm (flowers, seeds in a fruit); Cycas is a gymnosperm (cones, naked seeds).
- iv. The orange: its ovules are protected in an ovary, its flowers draw insects to carry pollen, and its fruit protects the seeds and helps spread them.

MARKING SCHEME

- ✓ i. Any one similarity, e.g. both have vascular tissue, or both make seeds.
- ✓ ii. Any one difference, e.g. flowers and seeds in a fruit against cones and naked seeds.
- ✓ iii. Orange: angiosperm (seeds in a fruit); Cycas: gymnosperm (naked seeds, cones).
- ✓ iv. The orange, with a reason such as protected ovules, flowers, or fruits that protect and spread the seeds.

7 Think

ANSWER

Only partly. Leaves give clues: sori underneath or a coiled young leaf point to a pteridophyte, needle-like leaves to a gymnosperm, broad leaves with net or parallel veins to an angiosperm. But leaves can mislead: Cycas, a gymnosperm, has feather-like leaves like a fern's. The subdivisions are defined by seeds, cones, flowers and fruits, so to be sure we need to see those.

MARKING SCHEME

- ✓ Partly: leaves give clues (sori, needles, broad net- or parallel-veined leaves).
- ✓ But leaves can mislead (e.g. Cycas's fern-like leaves); the subdivisions are defined by seeds, cones, flowers and fruits.

8 Activity: Maize and gram (Activities 2.4 and 2.5)

(not marked)

WHAT STUDENTS SHOULD FIND

Maize: parallel veins, fibrous roots (with prop roots), one cotyledon, a monocot (others: paddy, wheat, bamboo, banana, onion). Gram: a net of veins, a taproot, two cotyledons (the soaked seed splits into two halves), a dicot (others: pea, mustard, mango, pumpkin, peepal).

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Peepal** (garden): Our peepal is *Ficus religiosa*; our weeping fig and creeping fig share its genus.
- **Peat Moss** (garden): Feel the peat moss: a bryophyte with no roots or veins, holding water like a sponge.
- **Pteris Fern** (garden): Turn a Pteris frond over: the brown lines along its edges are clusters of spore cases.
- **Cycas** (garden): Cycas looks like a palm but is a gymnosperm: its seeds sit naked, not inside a fruit.
- **Leaf Shapes and Veins** (exhibit): Compare the veins: a branching net in dicot leaves, straight parallel lines in monocots.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	12	13	7	2	34





Unit 2 • Classification of Living Beings: animals

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. Porifera → e. body full of pores; adults fixed to one place
2. Coelenterata → a. tentacles with stinging cells round the only opening
3. Platyhelminthes → f. flat body, mostly parasites with suckers
4. Nematelminthes → c. long, round body pointed at both ends, not segmented
5. Annelida → d. body divided into rings, with a moist skin
6. Arthropoda → g. jointed legs and an exoskeleton of chitin

K • 3

Each carries 0.5 mark.

2 Label the diagram

1. gill cover (operculum): the gills are under it
2. eye
3. mouth
4. pectoral fins (pair)
5. dorsal fin
6. pelvic fins (pair)
7. lateral line
8. scales
9. anal fin
10. tail fin

K • 5

Each carries 0.5 mark.

3 Multiple choice

- i. c. Aves

K • 1

Feathers are found only in birds (Aves).

- ii. a. radial

K • 1

Several lines through the center, each giving two matching halves: that is radial symmetry. Bilateral symmetry has only one such line (left and right). Fun fact: a starfish larva is bilaterally symmetrical, and only becomes radial as it grows up.

- iii. b. they are multicellular and heterotrophic

U • 1

Kingdom Animalia is defined by many cells (without cell walls) and heterotrophic nutrition. Neither is a parasite, and laying eggs is not what defines the kingdom (many animals don't).

- iv. d. they give birth to young and suckle them with milk

U • 1

Lungs are found in reptiles and birds too, and every vertebrate has a backbone. Feeding the young with milk from mammary glands is the feature found only in mammals.

- v. d. Platyhelminthes, Nematelminthes, Annelida

A • 1

All three are triploblastic, bilaterally symmetrical worms, sharing many features. The other options join very simple animals (sponges, coelenterates) with very complex ones.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ A flexible rod along the back, between the nerve cord and the gut.

- b. MARKING SCHEME

K • 1

✓ Nephridia.

- c. MARKING SCHEME

U • 1

✓ Hair on the body, or feeding its young with milk (mammary glands).



5 Short answers

a. MARKING SCHEME

U • 2

- ✓ Any one difference, e.g. a fish breathes with gills, a whale with lungs; or a fish has a two-chambered heart, a whale four.
- ✓ Any second difference, e.g. a fish is cold-blooded, a whale warm-blooded; or a fish mostly lays eggs, a whale gives birth and feeds its calf milk.

b. MARKING SCHEME

U • 2

- ✓ A class is decided by many features together, not by one.
- ✓ The crocodile has dry, horny scales, is cold-blooded, breathes with lungs and lays shelled eggs on land: the features of reptiles.

c. MARKING SCHEME

A • 2

- ✓ Both have hair, give birth to their young and feed them milk from mammary glands.
- ✓ Both are warm-blooded, with a four-chambered heart and lungs: the features of class Mammalia (their shapes only suit their ways of life).

d. MARKING SCHEME

U • 2

- ✓ Water flowing through the canal system brings tiny food particles, which the collar cells catch.
- ✓ The food is digested inside the cells, in food vacuoles (intracellular digestion), and passed on to other cells.

6 Long answers

a. ANSWER

A • 4

- i. The fish.
- ii. The tiger.
- iii. Any two: both are vertebrates; both are cold-blooded; both have a three-chambered heart; both breathe with lungs as adults; both lay eggs.
- iv. The pigeon.

MARKING SCHEME

- ✓ i. Fish.
- ✓ ii. Tiger.
- ✓ iii. Any two similarities, e.g. cold-blooded, three-chambered heart, vertebrates.
- ✓ iv. Pigeon.

b. ANSWER

HA • 4

- i. The bat is in class Mammalia; the eagle in class Aves (both in phylum Chordata).
- ii. Both fly with forelimbs changed into wings; both are warm-blooded, with a four-chambered heart and lungs.
- iii. The bat has hair, the eagle feathers; the bat gives birth and feeds its young milk, the eagle lays eggs (also: teeth against a beak).
- iv. Both wings are built from the same bones as our arm (one upper-arm bone, two forearm bones, wrist bones and fingers), which shows they came from a common four-limbed ancestor; but the wings are made differently (skin between long fingers, feathers along the arm), so flight evolved separately in each line.

MARKING SCHEME

- ✓ i. Bat: Mammalia; eagle: Aves.
- ✓ ii. Two similarities, e.g. forelimbs are wings; warm-blooded; four-chambered heart.
- ✓ iii. Two differences, e.g. hair against feathers; gives birth and feeds milk against lays eggs.
- ✓ iv. The same bones in both wings show a common ancestor, built into wings in different ways.



7 Think

ANSWER

HA · 2

A phylum is decided by its basic body plan, not by one feature. Like a snail, the octopus has a soft body with a head, a visceral mass covered by a mantle, and a muscular foot (in the octopus the foot has become its eight arms). Not every mollusk has a shell (a slug has none, a cuttlefish's is inside), and many mollusks are bilaterally symmetrical.

MARKING SCHEME

- ✓ It has the mollusk body plan: a soft body with a head, a visceral mass and a mantle.
- ✓ Its muscular foot has become its arms; a shell and a coiled body are not found in every mollusk.

8 Activity: Classify the animals around you (Project 2.2)

(not marked)

WHAT STUDENTS SHOULD FIND

Earthworm: no legs, no backbone, moist skin with rings, Annelida. Common finds: an ant, fly or beetle (6 jointed legs, chitin exoskeleton, Arthropoda, an insect), a spider (8 legs, Arthropoda, not an insect), a snail or slug (no legs, a muscular foot, soft body, Mollusca), a millipede (many legs, Arthropoda), a lizard (4 legs, backbone, dry scales, Chordata, Reptilia), a sparrow (2 legs, feathers, Aves).

See it at Science Playground

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- **Shrimp Tank with a Sandfall** (exhibit): These shrimp are arthropods: jointed legs, a skeleton outside, shed whole to grow.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	12	9	7	6	34

