

Biological Classification — 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

Earlier Systems of Classification

1. State two drawbacks of the two-kingdom system.
2. What are the main criteria used by Whittaker for classification?
3. Explain the five-kingdom classification and the criteria used.

Kingdom Monera

1. Distinguish between archaeobacteria and eubacteria.
2. Name the four types of bacteria based on shape.
3. Explain the nutritional diversity of bacteria.

Kingdom Protista

1. Write two characteristic features of dinoflagellates.
2. Name the three groups of protists.
3. Describe the major groups of Kingdom Protista with examples.

Kingdom Fungi

1. Name the four classes of fungi with one example each.
2. How do fungi obtain nutrition?
3. Describe the classes of Kingdom Fungi with examples.

Lichens and Mycorrhiza

1. State the role of each partner in a lichen.
2. Give two economic uses of lichens.
3. Describe the symbiosis in lichens and their significance.

Kingdom Plantae and Animalia — Overview

1. Distinguish between Kingdom Plantae and Animalia.
2. Name the algal groups included in Plantae.
3. Compare the main features of Kingdom Plantae and Kingdom Animalia.

Viruses, Viroids and Prions

1. Who discovered the virus and what was it called?
2. Name two viral diseases of plants and two of humans.
3. Distinguish between viruses, viroids and prions with examples.

Part B — Integrated problems (multi-topic)

1. Whittaker's five kingdoms removed many anomalies of the two-kingdom system. State the criteria he used and give one example of an organism whose placement changed.
2. Bacteria show enormous nutritional diversity. Classify them by mode of nutrition with examples, and state their role in nitrogen cycling.
3. A student observes a marine, unicellular, photosynthetic organism with a rigid silica shell. Identify its group and justify your answer.
4. Describe the symbiosis in a lichen and explain why lichens are described as pollution indicators.
5. Compare viruses, viroids and prions with respect to their genetic material and the diseases they cause.
6. Distinguish Archaeobacteria into their three groups and explain how each is adapted to its habitat.

Answer Key

Earlier Systems of Classification

Drawbacks: (i) it grouped prokaryotes with eukaryotes and unicellular with multicellular; (ii) fungi, placed with plants, are heterotrophic and differ fundamentally from autotrophic plants. Whittaker's criteria: cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships. Five kingdoms: Monera (prokaryotic, e.g. bacteria), Protista (eukaryotic unicellular, e.g. Chlamydomonas), Fungi (heterotrophic eukaryotes with chitin walls, e.g. mushroom), Plantae (autotrophic eukaryotes), Animalia (holozoic eukaryotes).

Kingdom Monera

Archaeobacteria live in extreme habitats (halophiles, thermoacidophiles, methanogens) and have a different cell-wall structure; eubacteria are the true bacteria with a peptidoglycan wall. Shapes: coccus, bacillus, spirillum and vibrio. Nutrition: photoautotrophic, chemoautotrophic and heterotrophic (saprophytic, parasitic). They participate in nitrogen fixation and decomposition.

Kingdom Protista

Dinoflagellates: mostly marine, photosynthetic, cells with a stiff cellulose plate; some cause red tides. Three groups: photosynthetic protists (diatoms, dinoflagellates, euglenoids); slime moulds; protozoans. Examples — diatoms (silica shell), Euglena (pellicle), Paramecium, Amoeba, Plasmodium.

Kingdom Fungi

Classes: Phycomycetes (e.g. Mucor, Rhizopus), Ascomycetes (e.g. Penicillium, yeast), Basidiomycetes (e.g. Agaricus, Puccinia), Deuteromycetes (e.g. Alternaria, Colletotrichum). Fungi are heterotrophic — saprophytic, parasitic or symbiotic — absorbing nutrients; reserve food is glycogen. Useful as food (mushrooms), in antibiotics (penicillin) and in baking/brewing (yeast); harmful as pathogens and spoilage agents.

Lichens and Mycorrhiza

In a lichen the algal partner (phycobiont) photosynthesises and makes food, while the fungal partner (mycobiont) provides shelter, absorbs water and mineral nutrients. Uses: food (some species), antibiotics, litmus. Lichens are pollution indicators because they are very sensitive to SO₂ and do not grow in polluted areas.

Kingdom Plantae and Animalia — Overview

Plantae: eukaryotic, multicellular, cell wall of cellulose, autotrophic (photosynthetic), reserve food starch — includes algae, bryophytes, pteridophytes, gymnosperms, angiosperms. Animalia: eukaryotic, multicellular, no cell wall, holozoic heterotrophic, reserve food glycogen, mostly motile. Algal groups in Plantae: Chlorophyceae, Phaeophyceae, Rhodophyceae.

Viruses, Viroids and Prions

Virus discovered by D. Ivanowsky (tobacco mosaic, called TMV). Plant viral diseases: mosaic of tobacco, leaf curl; human: AIDS, influenza, polio, mumps. Virus: nucleic acid (DNA or RNA) enclosed in a protein coat (capsid); viroid: free RNA without a protein coat (e.g. potato spindle tuber viroid); prion: misfolded infectious protein (e.g. bovine spongiform encephalopathy, CJD).

Integrated problems

1: Criteria — cell structure, thallus organisation, mode of nutrition, reproduction, phylogenetic relationships; fungi moved out of Plantae to their own kingdom. 2: Photoautotrophic, chemoautotrophic, heterotrophic (saprophytic/parasitic); nitrogen-fixing bacteria (*Rhizobium*) and decomposers cycle nitrogen. 3: Diatoms (Chrysophytes) — unicellular, marine, with a silica shell (frustule). 4: Alga makes food, fungus provides shelter and absorbs water/minerals; lichens are SO₂-sensitive pollution indicators. 5: Virus — DNA or RNA + protein coat; viroid — free RNA, no coat; prion — infectious protein; diseases: mosaic/TMV, potato spindle tuber, BSE/CJD. 6: Halophiles (high salt), thermoacidophiles (hot acid springs), methanogens (anaerobic, produce methane in marshes/gut).