

CLASS 11

BIOLOGY

NCERT SOLUTIONS

NCERT Solutions for Class 11 Biology Chapter 2: Biological Classification – Free PDF Download

Chapter 2, Biological Classification, moves beyond Aristotle's and Linnaeus's two-kingdom system to explain R.H. Whittaker's five-kingdom classification (Monera, Protista, Fungi, Plantae, Animalia), the criteria used to build it (cell structure, body organisation, mode of nutrition, reproduction, and phylogenetic re...

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Class 11 Biology Chapter 2 – Notes and Extra Questions

Chapter 2, **Biological Classification**, moves beyond Aristotle's and Linnaeus's two-kingdom system to explain **R.H. Whittaker's five-kingdom classification** (Monera, Protista, Fungi, Plantae, Animalia), the criteria used to build it (cell structure, body organisation, mode of nutrition, reproduction, and phylogenetic relationships), and the special status of non-cellular agents like viruses, viroids, prions, and lichens. Below are accurate, exam-ready answers to every question from the NCERT textbook exercise. These Class 11 Biology Chapter 2 solutions are also useful as quick revision notes before exams.

Exercises

Q1. Discuss how classification systems have undergone several changes over a period of time.

Early classification systems relied on simple, visible characters. **Aristotle** classified plants as trees, shrubs, and herbs, and divided animals into those with red blood and those without — a purely morphological, artificial system. **Linnaeus** later formalised a **two-kingdom system**, placing all organisms into Kingdom Plantae or Kingdom Animalia based on whether they were plant-like or animal-like. This system became inadequate because it failed to distinguish **eukaryotes from prokaryotes**, **unicellular from multicellular** organisms, and **photosynthetic organisms (e.g., algae) from non-photosynthetic ones (e.g., fungi)**. To address these gaps, **R.H. Whittaker (1969)** proposed a **five-kingdom classification** — Monera, Protista, Fungi, Plantae, and Animalia — based on cell structure, body organisation, mode of nutrition, mode of reproduction, and phylogenetic relationships. More recently, **Carl Woese** proposed a **three-domain system** (Archaea, Bacteria, and Eukarya), splitting Kingdom Monera into two domains based on differences in cell membrane composition and ribosomal RNA sequences, effectively giving a six-kingdom view of life. This shows classification is a dynamic, evolving science that changes as new information about organisms becomes available.

Q2. State two economically important uses of: (a) heterotrophic bacteria (b) archaebacteria

(a) Heterotrophic bacteria: (i) They are used in the production of curd, cheese, and other fermented foods (e.g., *Lactobacillus*), and in antibiotic production. (ii) Many heterotrophic bacteria act as decomposers, recycling nutrients back into the soil, while others fix atmospheric nitrogen and increase soil fertility.

(b) Archaebacteria: (i) Methanogens present in the rumen of cattle and buffaloes help digest cellulose and are responsible for the production of biogas (gobar gas) from cattle dung. (ii) Halophilic and thermoacidophilic archaebacteria are used in the bioleaching of ores/mines and can survive in extreme environments such as salty areas and hot springs, making them useful in biotechnology.

Q3. What is the nature of cell walls in diatoms?

Diatoms have a rigid, indestructible cell wall made of two thin overlapping shells (called **frustules**) that fit together like a soap box, and this wall is embedded with **silica**. Because the wall does not decompose, diatoms leave behind large amounts of cell wall deposits at the bottom of water bodies over long periods of time. This accumulation is called **diatomaceous earth**, and being gritty, it is used in polishing, filtration, and as an insulator.

Q4. Find out what the terms 'algal bloom' and 'red tides' signify.

Algal bloom refers to the rapid, excessive multiplication of algae and other phytoplankton (including cyanobacteria) in a water body, usually triggered by a sudden rise in nutrients such as nitrates and phosphates (eutrophication). This overgrowth depletes dissolved oxygen and releases toxins, making the water toxic and often killing fish. **Red tides** refer to a related phenomenon in marine waters where rapid multiplication of red-pigmented dinoflagellates, such as *Gonyaulax*, colours the sea water reddish. These dinoflagellates release toxins that are extremely harmful to other marine animals such as fish, and can even affect humans who consume contaminated shellfish.

Q5. How are viroids different from viruses?

Viroids, discovered by **T.O. Diener (1971)**, are infectious agents that consist only of a free, low-molecular-weight, single-stranded RNA molecule — they lack the protein coat (capsid) that viruses possess. In contrast, a virus's nucleic acid (DNA or RNA) is enclosed within a protective protein coat. The RNA of a viroid is also much smaller than that of a virus and does not code for any protein. Viroids are known to cause diseases in plants, such as potato spindle tuber disease, whereas viruses infect plants, animals, and microorganisms alike.

Q6. Describe the four major groups of Protozoa briefly.

Protozoans are heterotrophic protists that live as predators or parasites and are grouped into four major types:

Amoeboid protozoans: Found in freshwater, seawater, or moist soil, these organisms (e.g., *Amoeba*, *Entamoeba*) move about and capture prey using pseudopodia (false feet). Some marine forms have shells made of silica.

Flagellated protozoans: These may be free-living or parasitic and use flagella for locomotion. *Trypanosoma*, a parasitic flagellate, causes African sleeping sickness in humans.

Ciliated protozoans: These are aquatic, actively motile organisms with thousands of cilia covering the body. They possess a cavity (gullet) that opens to the outside of the cell; *Paramecium* is a common example.

Sporozoans: This diverse group includes organisms with an infectious spore-like stage in their life cycle. *Plasmodium* (the malarial parasite) is the best-known example and is transmitted by the female *Anopheles* mosquito.

Q7. Plants are autotrophic. Can you think of some plants that are partially heterotrophic?

Yes. Insectivorous (carnivorous) plants such as *Drosera* (sundew), *Nepenthes* (pitcher plant), and *Utricularia* (bladderwort) are partially heterotrophic. These plants are green and photosynthetic (autotrophic) like other plants, but because they often grow in nitrogen-deficient soils, they trap and digest small insects to supplement their nitrogen requirement.

Q8. What do the terms phycobiont and mycobiont signify?

Lichens are a symbiotic association between an alga and a fungus that live together permanently for mutual benefit. The algal component of a lichen is called the **phycobiont**, and it prepares food for the association

through photosynthesis. The fungal component is called the **mycobiont**; it provides a protective structural covering, absorbs water and minerals, and shelters the alga from unfavourable environmental conditions. This close relationship allows lichens to survive as pioneer organisms in extreme habitats such as bare rocks.

Q9. Give a comparative account of the classes of Kingdom Fungi under the following: (i) mode of nutrition (ii) mode of reproduction

Class	Mode of Nutrition	Mode of Reproduction
Phycomycetes	Saprophytic or parasitic (found in aquatic habitats, on decaying wood, or as obligate parasites on plants)	Asexual reproduction by zoospores (motile) or aplanospores (non-motile); sexual reproduction by fusion of two gametes that may be similar (isogamous) or dissimilar (anisogamous/oogamous) in morphology, forming a zygospore
Ascomycetes	Mostly saprophytic, decomposers, parasitic, or coprophilous (growing on dung)	Asexual spores called conidia produced exogenously on conidiophores; sexual spores called ascospores produced endogenously in a sac-like ascus
Basidiomycetes	Saprophytic, growing in soil, on logs/tree stumps, or as parasites (e.g., rusts and smuts on crop plants)	Vegetative reproduction usually by fragmentation; asexual spores are generally absent; sexual reproduction occurs by fusion of two somatic cells of different strains (plasmogamy, karyogamy) forming basidiospores on a basidium
Deuteromycetes	Saprophytic, parasitic, or decomposers of litter (also called "Fungi Imperfecti")	Only asexual (through conidia) and vegetative reproduction are known; sexual stage is absent — when it is discovered, the fungus is reclassified into Ascomycetes or Basidiomycetes

Q10. What are the characteristic features of Euglenoids?

Euglenoids are mostly freshwater organisms found in stagnant water. Their key characteristics are: (i) They lack a rigid cell wall; instead, their body is covered by a protein-rich, flexible layer called a **pellicle**. (ii) They typically have two flagella of unequal length — a short one and a long one. (iii) They are **mixotrophic**: in the presence of sunlight they are photosynthetic (autotrophic), like *Euglena*, but in the absence of sunlight they behave like heterotrophs by predating on smaller organisms. This dual nutritional behaviour makes euglenoids an important evolutionary link between plants and animals.

Q11. Give a brief account of viruses with respect to their structure and nature of genetic material. Also, name four common viral diseases.

Viruses are **non-cellular, obligate intracellular parasites** that show no independent life activity outside a living host cell; outside the host, they can be crystallised like inert chemicals. Structurally, a virus consists of genetic material — either **DNA or RNA, but never both** — enclosed within a protective protein coat called

the **capsid**, which is made up of small subunits called **capsomeres**. Plant viruses mostly contain single-stranded RNA, whereas animal viruses may have single- or double-stranded RNA or DNA; bacteriophages (viruses that infect bacteria) are usually double-stranded DNA viruses. **Four common viral diseases** in humans are **influenza, AIDS, herpes, and mumps** (other examples include the common cold, chickenpox, and rabies).

Q12. Organise a discussion in your class on the topic ‘Are viruses living or nonliving?’

Viruses occupy a unique position at the border between living and non-living matter, showing characteristics of both.

Features suggesting they are non-living: They have no cellular structure; they can be crystallised and stored like inert chemical substances; they possess no metabolic machinery of their own and cannot generate or use energy; they cannot grow or reproduce independently outside a host cell.

Features suggesting they are living: They contain genetic material (DNA or RNA); they can multiply, but only inside a specific living host cell; they are host-specific, meaning each virus infects a particular host or group of hosts; they show antigenic properties and can undergo mutations, allowing them to evolve over time.

This dual nature is why viruses are usually described as being on the borderline between living and non-living entities, becoming “active” only within a host cell.

Class 11 Biology Chapter 2 – Notes and Extra Questions

Chapter 2 has a single, unified **Exercises** section with **12 questions** at the end of the chapter, and this count has remained unchanged through the 2023 rationalisation — it is the same set of questions found in earlier NCERT editions, just renumbered within the current 19-chapter Class 11 Biology structure. While revising, focus on Whittaker’s five-kingdom classification criteria (cell structure, body organisation, mode of nutrition, mode of reproduction, phylogenetic relationships), the sub-groups within Kingdom Monera (Archaeobacteria vs Eubacteria) and Kingdom Protista (Chrysophytes, Dinoflagellates, Euglenoids, Slime moulds, Protozoans), the four classes of Kingdom Fungi and their reproductive spores, and the distinguishing features of viruses, viroids, prions, and lichens, since these areas are consistently tested through both short-answer and comparison-based questions in board exams.

What is Whittaker’s five-kingdom classification, and on what basis was it proposed?

R.H. Whittaker proposed the five-kingdom classification in 1969, dividing all living organisms into **Monera, Protista, Fungi, Plantae, and Animalia**. The classification was based on several criteria used together: cell structure (prokaryotic or eukaryotic), body organisation (unicellular or multicellular), mode of nutrition (autotrophic or heterotrophic), mode of reproduction, and phylogenetic relationships between organisms.

How is Kingdom Monera further divided into Archaeobacteria and Eubacteria?

Kingdom Monera is divided based on differences in cell wall composition and the environments organisms inhabit. **Archaeobacteria** have a distinct cell wall structure that allows them to survive in extreme habitats such as hot springs (thermoacidophiles), salty areas (halophiles), and marshy areas (methanogens). **Eubacteria**, or “true bacteria,” have a rigid cell wall and include the vast majority of bacteria found in soil,

water, air, and living organisms.

What is the difference between a virus and a viroid?

A virus consists of genetic material (DNA or RNA) enclosed within a protective protein coat called a capsid. A viroid, in contrast, lacks this protein coat entirely — it is made up only of free, low-molecular-weight single-stranded RNA. Viroid RNA is also much smaller than viral RNA and does not code for any protein, yet viroids can still cause serious plant diseases.

What are lichens, and why are they considered a symbiotic association?

Lichens are a symbiotic association between algae and fungi that live together for mutual benefit. The alga (phycobiont) prepares food for both partners through photosynthesis, while the fungus (mycobiont) provides shelter, absorbs water and minerals, and protects the alga from harsh environmental conditions. Because both organisms benefit and depend on each other for survival, lichens are considered a classic example of symbiosis, and their presence is often used as an indicator of clean, unpolluted air.

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