

NCERT Exemplar Solutions of Class 11 Biology – Chapter: 2 Biological Classification.**VERY SHORT ANSWER TYPE QUESTIONS**

1. What is the principle underlying the use of cyanobacteria in agricultural fields for crop improvement?

Solution: Cyanobacteria are capable of fixing nitrogen with the help of specialized cells called heterocysts. They enrich soil fertility by converting atmospheric nitrogen into ammonia, which plants can utilize. Hence, blue-green algae (BGA) are used in agricultural fields. Examples include colonies of *Nostoc* and *Anabaena* that grow in paddy fields.

Explanation: Cyanobacteria possess the enzyme nitrogenase in their heterocysts, which catalyzes the reduction of atmospheric nitrogen (N_2) to ammonia (NH_3). This biological nitrogen fixation reduces the need for chemical fertilizers, making agriculture more sustainable and environmentally friendly.

2. Suppose you accidentally find an old preserved permanent slide without a label. In your effort to identify it, you place the slide under the microscope and observe the following features:

- Unicellular
- Well defined nucleus
- Biflagellate—one flagellum lying longitudinally and the other transversely.

What would you identify it as? Can you name the kingdom it belongs to?

Solution: According to the listed features, the organism must be a **dinoflagellate**. All eukaryotic unicellular organisms belong to the kingdom **Protista**.

Explanation: Dinoflagellates are characterized by their unique flagellar arrangement - one flagellum runs longitudinally (providing forward movement) while the other runs transversely in a groove around the cell (providing rotational movement). This gives them their characteristic spinning motion. Many dinoflagellates are photosynthetic and form an important part of marine phytoplankton.

3. How is the five-kingdom classification advantageous over the two-kingdom classification?

Solution: The five-kingdom classification addresses several limitations of the two-kingdom system:

- **Prokaryote vs. Eukaryote distinction:** Two-kingdom classification did not distinguish between prokaryotes and eukaryotes
- **Cellular organization:** It did not distinguish between unicellular and multicellular organisms
- **Nutritional modes:** It failed to distinguish between autotrophic/photosynthetic and heterotrophic/non-photosynthetic organisms

Explanation: The five-kingdom system provides a more natural classification based on:

1. **Cell structure** (prokaryotic vs. eukaryotic)

2. **Level of organization** (unicellular vs. multicellular)
3. **Mode of nutrition** (autotrophic vs. heterotrophic)
4. **Reproductive strategies** and **phylogenetic relationships**

4. Polluted water bodies have usually a very high abundance of plants like *Nostoc* and *Oscillatoria*. Give reasons.

Solution: Polluted water bodies are rich in nutrients, especially nitrogen content, which provides favorable conditions for algae like *Nostoc* and *Oscillatoria* to bloom in water bodies.

Explanation: This phenomenon is called **eutrophication**. Pollutants, particularly from agricultural runoff and sewage, increase nutrient levels (especially nitrates and phosphates) in water bodies. Cyanobacteria like *Nostoc* and *Oscillatoria* can efficiently utilize these nutrients and may also fix atmospheric nitrogen, giving them a competitive advantage and leading to algal blooms.

5. Are chemosynthetic bacteria autotrophic or heterotrophic?

Solution: Chemosynthetic bacteria are **autotrophic**. They gain energy for the synthesis of food by oxidizing inorganic substances.

Explanation: Chemosynthetic bacteria synthesize organic compounds using carbon dioxide as a carbon source and derive energy from the oxidation of inorganic chemicals such as hydrogen sulfide (H_2S), ammonia (NH_3), or iron compounds (Fe^{2+}). Examples include nitrifying bacteria, sulfur bacteria, and iron bacteria. This process is crucial in ecosystems where sunlight is not available, such as deep-sea hydrothermal vents.

6. The common name of pea is simpler than its botanical (scientific) name *Pisum sativum*. Why then is the simpler common name not used instead of the complex scientific/botanical name in biology?

Solution: Pea is known by different names in different countries. Instead of using a variety of names, scientific names are provided which are the same worldwide. It represents worldwide standardization of nomenclature.

Explanation: Scientific nomenclature follows the **binomial system** established by Linnaeus, which provides:

- **Universal recognition:** Same name used globally regardless of local language
- **Precision:** Each species has only one correct scientific name
- **Hierarchical information:** Shows relationships between organisms
- **Stability:** Names don't change with local preferences or languages
- **Legal clarity:** Important for international trade, conservation, and research

7. A virus is considered as a living organism and an obligate parasite when inside a host cell. But the virus is not classified along with bacteria or fungi. What are the characters of the virus that are similar to non-living objects?

Solution: Characteristics of viruses similar to non-living objects:

1. Viruses have no complete cellular structure
2. Don't show growth, division, metabolism, and lack respiration
3. High specific gravity
4. Don't follow Robert Koch's postulate
5. Cannot be grown under "in vitro" conditions

Explanation: Viruses exist at the boundary between living and non-living matter. They lack:

- **Cellular structure:** No cell membrane, cytoplasm, or organelles
 - **Metabolic machinery:** Cannot produce energy or synthesize proteins independently
 - **Independent reproduction:** Can only replicate using host cell machinery
 - **Response to environment:** No homeostasis or independent response mechanisms
- They can be crystallized like chemicals and remain inactive outside host cells.

8. In the five-kingdom system of Whittaker, how many kingdoms are eukaryotes?

Solution: Eukaryotes are organisms whose nucleus and organelles are bounded by membranes. **Four kingdoms** have eukaryotic organisms: a. **Protista**

b. **Fungi**

c. **Plantae**

d. **Animalia**

Explanation: Only the Kingdom Monera contains prokaryotic organisms (bacteria and archaea). The other four kingdoms consist entirely of eukaryotic organisms, which are characterized by having membrane-bound nuclei and organelles such as mitochondria, endoplasmic reticulum, and Golgi apparatus.

SHORT ANSWER TYPE QUESTIONS

1. Diatoms are also called as 'pearls of the ocean', why? What is diatomaceous earth?

Solution: Diatoms are majorly phytoplankton which are the chief producers of oceans. Hence, they are known as "**pearls of oceans.**"

Explanation:

- **"Pearls of the ocean":** Diatoms are called this because they are beautiful, microscopic organisms with intricate glass-like cell walls made of silica, and they are the primary producers in marine ecosystems
- **Diatomaceous earth:** This is a sedimentary deposit formed from the fossilized remains of diatoms. It consists of siliceous shells of dead diatoms and has various commercial uses including filtration, abrasives, and insecticides due to its fine, porous structure

2. There is a myth that immediately after heavy rains in forest, mushrooms appear in large number and make a very large ring or circle, which may be several metres in diameter. These are called 'Fairy rings'. Can you explain this myth of fairy rings in biological terms?

Solution: This naturally occurring ring or arch of mushrooms, occurring as a common turf disease, is identified as large dead rings or arches of grass in lawns during spring or summer and is known as '**fairy rings**'.

Explanation: Fairy rings are formed by the radial growth pattern of fungal mycelia. The fungus grows outward from a central point, depleting nutrients in the soil. As the central area becomes nutrient-poor, the fungus dies there, while the outer edge continues to grow where nutrients are still available. Mushrooms appear at the outer edge where the fungal growth is most active. Heavy rains provide the moisture needed for mushroom formation, making them suddenly visible in circular patterns.

3. Neurospora - an ascomycetes fungus has been used as a biological tool to understand the mechanism of plant genetics much in the same way as Drosophila has been used to study animal genetics. What makes Neurospora so important as a genetic tool?

Solution: *Neurospora* is used as a genetic tool because:

- **Fastest growing:** Can be grown in vitro in minimal media
- **Haploid nature:** Due to its haploid nature, it can express both dominant as well as recessive traits
- **Genetic analysis:** Analysis of genetic combinations is facilitated by the ordered sequence of products in the form of eight ascospores

Explanation: *Neurospora crassa* is particularly valuable for genetic research because:

- **Short life cycle:** Rapid reproduction allows quick genetic studies
- **Minimal nutritional requirements:** Can grow on simple defined media
- **Ordered ascospores:** The eight spores in each ascus are arranged in a specific order that reflects the genetic events during meiosis
- **Easy manipulation:** Can be easily cultured and manipulated in laboratory conditions
- **Biochemical mutations:** Useful for studying metabolic pathways and enzyme functions

4. Cyanobacteria and heterotrophic bacteria have been clubbed together in Eubacteria of kingdom Monera as per the "Five Kingdom Classification" even though the two are vastly different from each other. Is this grouping of the two types of taxa in the same kingdom justified? If so, why?

Solution: Cyanobacteria synthesize their food and are autotrophic. Heterotrophic bacteria depend on other organisms for food. Both cyanobacteria and heterotrophic bacteria are categorized under Eubacteria of kingdom Monera. Therefore, the classification according to cellular structure is justified.

Explanation: This grouping is justified because classification primarily considers:

- **Cellular organization:** Both are prokaryotic (lack membrane-bound nucleus)
- **Cell wall composition:** Both have peptidoglycan in their cell walls
- **Genetic material:** Both have circular DNA not associated with histones

- **Ribosomes:** Both have 70S ribosomes
- **Evolutionary relationship:** Both share common prokaryotic ancestry

While their nutritional modes differ, the fundamental cellular structure and organization are similar enough to justify their placement in the same kingdom.

5. At a stage of their cycle, ascomycetes fungi produce the fruiting bodies like apothecium, perithecium or cleistothecium. How are these three types of fruiting bodies different from each other?

Solution:

- **Apothecium:** Saucer or cup-shaped, open fruiting body
- **Perithecium:** Flask-shaped fruiting body with an opening lid called the ostiole
- **Cleistothecium:** Closed spherical structure where ostiole is absent

Explanation: These fruiting bodies (ascocarps) differ in their structure and spore release mechanisms:

- **Apothecium:** Open, disc-like structure that exposes asci directly to environment for spore dispersal (e.g., in *Peziza*)
- **Perithecium:** Flask-shaped with a narrow opening (ostiole) through which ascospores are released, often forcibly ejected (e.g., in *Sordaria*)
- **Cleistothecium:** Completely closed, spherical structure that releases spores only when the wall ruptures or decays (e.g., in powdery mildews)

6. What observable features in *Trypanosoma* would make you classify it under kingdom Protista?

Solution: Observable features of *Trypanosoma* that classify it under kingdom Protista:

- Unicellular eukaryotic organism
- Locomotion facilitated by flagella
- Method of reproduction is asexual
- Reserve food material present in the form of granules

Explanation: *Trypanosoma* exhibits typical protistan characteristics:

- **Eukaryotic cellular organization:** Membrane-bound nucleus and organelles
- **Unicellular structure:** Single-celled organism
- **Motility:** Possesses flagella for movement
- **Parasitic lifestyle:** Lives as parasite in blood and tissues
- **Binary fission:** Reproduces asexually
- **Metabolic independence:** Can carry out basic metabolic processes (unlike viruses)

7. Fungi are cosmopolitan. Write the role of fungi in your daily life.

Solution: Industrial applications:

- **Brewery and baking industry:** *Saccharomyces cerevisiae* is used. Under anaerobic conditions, fermentation produces ethanol and CO₂. CO₂ release helps dough rise

- **Biological control agents:** Soil-inhabiting fungus *Trichoderma* kills *Pythium* fungus known to cause root rot

Explanation: Fungi play numerous roles in daily life: **Beneficial roles:**

- **Food production:** Mushrooms, cheese production, bread making, alcoholic beverages
- **Medicine:** Antibiotics (penicillin), immunosuppressants (cyclosporin)
- **Biotechnology:** Enzyme production, waste decomposition
- **Agriculture:** Mycorrhizal associations improve plant nutrition

Harmful roles:

- **Disease causation:** Plant diseases, human infections (athlete's foot, ringworm)
- **Food spoilage:** Decomposition of stored food products

