

CLASS 9 SCIENCE — CHAPTER 12

NCERT SOLUTIONS

Patterns in Life: Diversity and Classification

New NCERT *Exploration* Textbook | 2026–27

The chapter-end “Revise, Reflect, Refine” section contains **15 questions**.

Q1. Identifying an Insect

Question:

Meena and Hari observe an animal. Hari calls it an insect while Meena says it is an earthworm. Which feature confirms that it is an insect?

- (i) Bilateral symmetry
- (ii) Body with jointed legs
- (iii) Cylindrical body
- (iv) Body with little segmentation

 **Answer: (ii) Body with jointed legs**

Explanation:

Insects belong to **Phylum Arthropoda**.

A major characteristic of arthropods is:

- Jointed legs
- Segmented body
- Hard external skeleton

An earthworm belongs to **Phylum Annelida** and does not have jointed legs.

 **Therefore:**

Jointed legs → Arthropoda → Insect



Q2. Why Are Sponges Animals?

Sponges have a simple body plan and lack true tissues and organs.

Which feature supports their classification under Kingdom Animalia?

- (i) Absence of mitochondria
- (ii) Ability to photosynthesise
- (iii) Presence of a cell membrane
- (iv) Presence of a cell wall



Answer: (iii) Presence of a cell membrane



Explanation:

Animal cells have a **cell membrane** but do not have a cell wall.

Sponges are animals even though their body organisation is very simple.

They do not:

- Have chloroplasts
- Have a cellulose cell wall
- Perform photosynthesis as plants do



Answer:

Presence of a cell membrane.



Q3. How Can We Distinguish Different Animals?

Question:

Observe two different animals. What features help distinguish them and place them into different groups?

Answer:

Scientists compare several characteristics rather than relying on just one feature.

Important characteristics include:

♦ **1. Body symmetry**

- Bilateral symmetry
- Radial symmetry
- No definite symmetry

♦ **2. Level of organisation**

- Cellular level
- Tissue level
- Organ level
- Organ-system level

♦ **3. Body organisation**

Scientists examine:

- Body shape
- Segmentation
- Presence or absence of appendages
- Body covering

♦ **4. Special structures**

Examples:

- Notochord
- Backbone
- Jointed legs
- Shell
- Tentacles

 Conclusion:

These characteristics help scientists place animals into appropriate **phyla and groups**.



Q4. Why Is Cellular Organisation a Fundamental Basis of Classification?

Question:

Why is cellular organisation more fundamental for classification than the presence of xylem and phloem?

Answer:

Cellular organisation is a basic feature of all cellular organisms.

Organisms can differ as:

- Prokaryotic or eukaryotic
- Unicellular or multicellular
- Different levels of tissue and organ organisation

Xylem and phloem, however, are specialised structures found only in certain plants.

Therefore, cellular organisation can be applied to a much wider range of organisms.



Answer:

Cellular organisation is a more fundamental characteristic because it applies broadly to living organisms, whereas xylem and phloem are specialised structures restricted mainly to vascular plants.



Q5. Identify the Unicellular Organism

Question:

A slide contains a single-celled organism with:

- A well-defined nucleus
- Multiple cilia

Which group is it most likely to belong to?

✅ **Answer: Protista**

🧠 **Explanation:**

The organism is:

- **Unicellular**
- **Eukaryotic** because it has a true nucleus
- Capable of movement using **cilia**

These are characteristic features of many protists such as **Paramecium**.

★ **Answer:**

Kingdom Protista



Q6. Importance of Biodiversity

Question:

How does diversity of organisms contribute to the balance and stability of an ecosystem?

Answer:

Biodiversity means the variety of living organisms in an area.

Different organisms perform different roles in an ecosystem.

🌱 **Plants** → Producers

🐛 **Herbivores** → Primary consumers

🦁 **Carnivores** → Higher-level consumers

🍄 **Fungi and bacteria** → Decomposers

Biodiversity helps maintain:

- Food chains and food webs

- Pollination
- Decomposition
- Nutrient cycling
- Soil fertility
- Ecosystem stability

★ Answer:

Greater biodiversity provides a variety of ecological roles and interactions, helping ecosystems remain balanced and more resilient to environmental changes.



Q7. Why Not Put All Unicellular Organisms in One Kingdom?

Answer:

All unicellular organisms are not alike.

Some are:



Prokaryotic

Example: **Bacteria**

They lack a true nucleus.

Others are:



Eukaryotic

Example: **Amoeba, Paramecium, Euglena**

They have a true nucleus.

Some are:

- Autotrophic
- Heterotrophic
- Photosynthetic
- Absorptive

Therefore, simply being unicellular is not enough to place an organism in one kingdom.

★ **Answer:**

Unicellular organisms differ in cell type, nutrition, organisation and other characteristics, so they cannot all be placed in a single kingdom.



Q8. Why Are Viruses Not Included in the Five Kingdoms?

Answer:

Viruses are different from cellular organisms.

They:

- Contain genetic material
- Lack cellular organisation
- Do not have a complete cell structure
- Cannot reproduce independently outside a host cell
- Remain inactive outside a suitable host

The five-kingdom system is designed primarily for **cellular forms of life**.

Therefore:

✓ **Viruses are kept outside the five-kingdom classification.**



Q9. Should Viruses Have a Separate Category?

Question:

If you revised the five-kingdom classification, would you create a separate category for viruses or keep them outside it?

Answer:

A reasonable approach would be to keep viruses **outside the five kingdoms** or create a separate category specifically for acellular entities.

Viruses have:

- Genetic material
- Protein covering

but lack a cellular structure.

They therefore do not fit naturally into kingdoms based on cellular organisation.

★ What does this show?

Scientific classification is **not fixed forever**.

As scientists discover new information, classification systems can be modified and improved.

✓ Answer:

Viruses may be kept outside the five kingdoms because they are acellular. Their unusual nature shows that classification systems have limitations and may evolve with new scientific knowledge.



Q10. Why Do Viruses Not Fit the Five-Kingdom System?

Answer:

The five kingdoms are based mainly on characteristics of **cellular organisms**.

Viruses lack:

- ✗ Cell membrane as a complete cell structure
- ✗ Cytoplasm
- ✗ Cellular organisation

✗ Independent metabolism

✗ Independent reproduction

They contain genetic material but depend on host cells for reproduction.

★ Conclusion:

Viruses demonstrate that not every biological entity can be placed neatly into a classification system designed for cellular organisms.

Q11. Bryophytes vs Pteridophytes

Question:

Both bryophytes and pteridophytes lack flowers and seeds. Why are they placed in different groups?

Bryophytes

Examples:

- Mosses
- Liverworts

Characteristics:

- No true vascular tissues
- No true roots, stems and leaves like vascular plants
- Reproduce through spores
- Usually live in moist environments

Pteridophytes

Examples:

- Ferns

Characteristics:

- Have **vascular tissues**
- Have true roots, stems and leaves

- Reproduce through spores
- Do not produce seeds

★ Key Difference:

Feature	Bryophytes	Pteridophytes
Vascular tissue	✗ Absent	✓ Present
True roots/stems/leaves	✗ Absent	✓ Present
Seeds	✗ Absent	✗ Absent
Spores	✓ Present	✓ Present

✓ Answer:

Bryophytes lack vascular tissues, whereas pteridophytes possess vascular tissues and have a more differentiated plant body.



Q12. Class or Genus?

Question:

Which group has fewer members but more features in common — **class or genus?**

✓ Answer: Genus

The classification hierarchy is:

Kingdom → Phylum → Class → Order → Family → Genus → Species

As we move downward:

↓ Number of organisms decreases

↑ Similarity increases

Therefore, a genus contains fewer organisms than a class and its members share more characteristics.

★ Answer:

Genus



Q13. Unicellular + Autotrophic + Locomotion

Question:

A scientist discovers a new organism showing:

- Locomotion
- Autotrophic nutrition

Which characteristics would help identify it as **Protista**?

Answer:

Locomotion and autotrophic nutrition alone are **not enough**.

The scientist should first check whether it is:

♦ **Unicellular**

and

♦ **Eukaryotic**

Protista includes many unicellular eukaryotes.

Some protists are:



Autotrophic

while others are:



Heterotrophic.

Example:

Euglena

Euglena can:

- Photosynthesise in light
- Move using a flagellum

✓ Answer:

If the organism is unicellular and eukaryotic, its combination of locomotion and autotrophic nutrition could place it in Protista.



Q14. Can a Unicellular Organism Be a Fungus?

Question:

A researcher identifies a unicellular eukaryotic organism as fungi. What features should be checked?

Answer:

Unicellularity alone does not exclude an organism from Kingdom Fungi.

The organism should have fungal characteristics such as:



1. Eukaryotic cell

It must have a true nucleus.



2. Heterotrophic nutrition

Fungi obtain food by **absorption**.



3. Chitinous cell wall

The fungal cell wall contains **chitin**.



Example:

Yeast is a unicellular fungus.

✓ **Answer:**

A unicellular organism can belong to Fungi if it is a **eukaryote, obtains nutrition heterotrophically by absorption and has a chitinous cell wall.**



Q15. Case Study — Organisms P, Q, R, S and T

The textbook gives the following observations:

Organism	Important features
P	Microscopic, no true nucleus, rigid cell covering, survives high salinity and temperature
Q	Multicellular, filamentous, cell wall, no chlorophyll, grows on dead organic matter
R	Unicellular, true nucleus, contractile vacuole, flagella, photosynthesis in light and heterotrophic in darkness
S	Multicellular, differentiated tissues, backbone, aquatic respiration during early life
T	Acellular, genetic material, inactive outside host

(i) Identify an organism belonging to Kingdom Fungi.

✓ **Answer: Q**

Why?

Q is:

- Multicellular
- Filamentous
- Has a cell wall

- Lacks chlorophyll
- Grows on dead organic matter

These are characteristic features of fungi.

 **Therefore:**

Q → Kingdom Fungi

(ii) Which organism belongs to Kingdom Monera?

 **Answer: P**

Why?

P:

- Is microscopic
- Has **no true nucleus**
- Has a rigid cell covering

The absence of a membrane-bound nucleus indicates a:

Prokaryotic organism

Therefore:

P → Kingdom Monera

(iii) Why Are R and Q in Different Kingdoms?

Both R and Q are **eukaryotic**.

But they differ in several important characteristics.

R:

- Unicellular
- Eukaryotic
- Shows locomotion
- Can photosynthesise
- Can also show heterotrophic nutrition

Q:

- Multicellular
- Filamentous
- Has cell wall
- Lacks chlorophyll
- Heterotrophic by absorption

Therefore, they are placed in different kingdoms.

★ **Key criteria:**

Cellular organisation + number of cells + nutrition + other structural features

(iv) Why Can't S Be Classified Only by Nutrition?

S is multicellular and heterotrophic.

But many organisms are heterotrophic, including:

- Animals
- Fungi
- Some protists

Therefore, nutrition alone cannot identify its kingdom.

S has additional important characteristics:

- Well-differentiated tissues
- Backbone
- Aquatic respiration during early life

These structural and developmental features are important for classification.

 Answer:

Mode of nutrition alone is insufficient because many different groups can share the same nutritional mode. Structural organisation and other characteristics must also be considered.

(v) Why Does T Not Fit into the Five Kingdoms?

T is:

- Acellular
- Contains genetic material
- Inactive outside a host
- Dependent on a host for reproduction

The five kingdoms classify **cellular forms of life**.

T lacks:

Cellular organisation

Therefore, it does not fit into the five-kingdom system.

What does this show?

Classification systems have limitations.

As science advances, scientists may need to modify or expand classification systems.

 Answer:

T is acellular, so it does not fit into the five kingdoms. This shows that classification systems are models that may need refinement when new biological entities are discovered.



CHAPTER 12 — COMPLETE ANSWER KEY

Q	Answer
1	(ii) Jointed legs
2	(iii) Cell membrane
3	Compare symmetry, organisation, segmentation, structures, etc.
4	Cellular organisation is more fundamental and broadly applicable
5	Protista
6	Biodiversity maintains food webs, nutrient cycling and ecosystem stability
7	Unicellular organisms differ in cell type, nutrition and organisation
8	Viruses are outside the five kingdoms because they are acellular
9	Keep outside or create a separate acellular category; classification evolves
10	Viruses lack cellular organisation and independent metabolism/reproduction
11	Bryophytes lack vascular tissue; pteridophytes possess it
12	Genus
13	Unicellular + eukaryotic + autotrophic features → may indicate Protista
14	Eukaryotic + absorptive heterotrophic + chitinous cell wall
15(i)	Q → Fungi
15(ii)	P → Monera
15(iii)	R and Q differ in organisation, nutrition and other features
15(iv)	Nutrition alone cannot classify S
15(v)	T lacks cellular organisation

The textbook/answer material confirms the objective answers **Q1 = (ii), Q2 = (iii), Q5 = Protista, Q8 = outside five kingdoms, Q11 = Bryophyta vs Pteridophyta, Q12 = Genus,**

Q13 = unicellular eukaryote + autotrophic nutrition → Protista, and the full case-study answers for Q15.

CHAPTER 12 — IMPORTANT REVISION NOTES

Five Kingdom Classification

Kingdom	Cell type	Organisation	Nutrition
 Monera	Prokaryotic	Mostly unicellular	Autotrophic / heterotrophic
 Protista	Eukaryotic	Mainly unicellular	Autotrophic / heterotrophic
 Fungi	Eukaryotic	Mostly multicellular	Heterotrophic by absorption
 Plantae	Eukaryotic	Multicellular	Autotrophic
 Animalia	Eukaryotic	Multicellular	Heterotrophic

Plant Classification Sequence

Thallophyta → Bryophyta → Pteridophyta → Gymnosperms → Angiosperms

As plant groups become more complex:

Vascular tissues → Seeds → Flowers

become important distinguishing features.

Animal Classification

Non-chordates:

Porifera → Cnidaria → Platyhelminthes → Nematoda → Annelida → Arthropoda → Mollusca → Echinodermata

Chordates:

- Protochordates
- Vertebrates

Vertebrates:

 Fish
 Amphibians
 Reptiles
 Birds
 Mammals



TAXONOMIC HIERARCHY

Remember:

Kingdom → Phylum → Class → Order → Family → Genus → Species

 **Easy memory:**

King
Philip
Came
Over
For
Good
Soup

As we move from **Kingdom** → **Species**:

 Number of organisms decreases

 Similarities increase



BINOMIAL NOMENCLATURE

Every scientific name has **two parts**:

Genus + species

Example:

Panthera tigris → Tiger

Mangifera indica → Mango

The **genus starts with a capital letter**, while the species name starts with a **small letter**.



MOST IMPORTANT EXAM POINTS

- ♦ **Monera** → Prokaryotic
- ♦ **Protista** → Mainly unicellular eukaryotes
- ♦ **Fungi** → Chitin cell wall + absorptive nutrition
- ♦ **Plantae** → Multicellular autotrophs
- ♦ **Animalia** → Multicellular heterotrophs
- ♦ **Viruses** → Acellular
- ♦ **Bryophytes** → No vascular tissues
- ♦ **Pteridophytes** → Vascular tissues but no seeds
- ♦ **Gymnosperms** → Naked seeds
- ♦ **Angiosperms** → Flowers and enclosed seeds
- ♦ **Arthropoda** → Jointed legs
- ♦ **Annelida** → Segmented body
- ♦ **Genus** has fewer members and greater similarity than **Class**
- ♦ **Classification** is a scientific system that can be revised as knowledge develops.

