

# 1

## The Living World



*When we leave cooked or uncooked food at room or warmer temperature for an extended, period of time, it begins to spoil. Almost everyone has seen the green discoloration that ruins food and spreads quickly. Microorganisms require a warm environment to multiply and divide. This is how living organisms grow.*

### Topic Notes

- *Basics of Living World*



## TOPIC 1

### BIODIVERSITY

#### Diversity

The earth has a wide range of ecosystems in which huge varieties of animals are found. The most extraordinary thing is different habitats have different diversity of animals living in them. **Examples:** Camels are found in deserts, fishes are found in the aquatic ecosystem, polar bears live in Arctic region, etc. Diversity is what makes the ecosystem harness the energy needed to live and sustain life to continue. Diversity refers to the different kinds of living organisms found in various habitats on earth. All the

diverse organisms present are part of biodiversity (*bio* means living and *diversity* refers to the variety and range of organisms found on this planet).



Diversity of organisms found in the living world

## TOPIC 2

### NOMENCLATURE AND CLASSIFICATION

#### Nomenclature

There are so many plants and animals on this planet earth. We identify plants and animals by local names given by us. Their local names can vary from place to place, locality to locality or country to country.

Therefore, this world needs standardised names for the organism, so that they can easily be identified by same name all over the world. This is why we need **Nomenclature**. The nomenclature is the only possible way to recognise the organisms and this is known as **identification**.

Nomenclature is the process of naming living organisms, so that they can be known by a single identity all over the world and can be identified by everyone (identification) without any difficulty. **International Code for Botanical Nomenclature (ICBN)** and **International Code of Zoological Nomenclature (ICZN)** names the plants and animals respectively on the basis of certain principles and criteria given by the plant and animal taxonomists. Some scientists decided to name the plant based on its origin and discoverer but this idea was not widely accepted. Carolus Linnaeus created the binomial system of nomenclature in order to create a consistent system, for naming species. In this system, the names are usually in Latin language and written in italics.

Every organism has a unique name according to binomial nomenclature, made up of two components, the first component is the Generic name and second component is specific epithet, e.g., *Mangifera indica* in which *Mangifera* is the genus name and *indica* is a specific epithet. This unique system of naming is what helps people all around the globe to identify any species, so that the studies and knowledge could be shared to all without any difficulty or confusion. The nomenclature is not only a means of naming the species but it also sought to help in solving the scientific conflicts among the scientific community and common people.

Before naming or writing the name of any organism either plant or animal, a certain set of rules should be considered which are globally well-accepted and followed by the entire scientific community. Rules of binomial nomenclature are as follows:

- (1) The scientific name generally originated from Latin. As stated earlier, the Latin language is a dead language because this language is not an official or national language of any country anymore and hence, it is safe to use Latin for naming in order to avoid any claim over the named species.



- (2) The biological name when printed is written in italics and if hand-written is underlined separately. This is an action performed so that the scientific species name could be distinguished from the rest of other words and the species name itself could be highlighted in the long elaborated text. It signifies their Latin origin.
- (3) The first name represents the genus and the second name represents the specific epithet. The genus name can include many species but the specific epithet of a genus remains unique. In short, the species name given in binomial nomenclature is unique and cannot be possibly shared with any other species.
- (4) The genus (first) name starts with a capital letter and the specific epithet (second) name starts with a small letter as seen in the example of *Solanum tuberosum*. Although while mentioning any species name in the title of the scientific publication, some authors choose not to use the italic font while writing the species name. This way scientific writing for some might be considered a bit unconventional but actually, it is a matter of editorial discretion to find and accept such kind of scientific writing.



### Important

↳ The concept of binomial nomenclature was given by *Carolus Linnaeus*.

**Example 1.1:** Given below is the scientific name of Mango. Identify the correctly written name.

- (a) *Mangifera indica*                      (b) *Mangifera Indica*  
 (c) *Magnifera indica*                      (d) *mangifera indica*

[NCERT]

**Ans.** (a) *Mangifera indica*

**Explanation:** According to the binomial nomenclature rules, the first name of any organisms *ie.*, genus must be start with a capital letter and the second word, *ie.*, specific-epithet must be start with a small letter as seen in *Mangifera indica*. Both the names should be italicised as well.

**Example 1.2:** Why are classifications changing every now and then? [NCERT]

**Ans.** Different scientists and researchers are attempting to simplify the classification most fitted method. All classifications are based on certain similarities and characteristics but the more extensive study reveals more findings and everyday attempt is being made to new discoveries of characters if not species, hence the existing classifying criteria keep on challenging and thus, need to be changed from time to time.

### Classification

When we have a large number of individuals to deal with, we tend to classify them for better handling of

the situation. In nature, we have numerous organisms and their study is not easy, therefore, if we do not categorize or classify them, the entire study will turn into chaos, to avoid that, we use scientific rules and principles to determine a method of global acceptance to classify all the known organisms present on this planet. Classification is the process of dividing organisms into different categories on the basis of observable characteristics.

### Example 1.3: Case Based:

A scientist discovered a plant species unknown to him. He decides to remove it from its natural habitat to study it more extensively. Upon doing so, he tried to identify the species and found out that the plant has no record in the database which implies that it is an entirely new species. The discovery of any new species brings more diversity to nature and its study reveals the hidden secrets of the biological world. Each species is unique in its own way and yet it shares some similarities with others. The similarities are due to the relatedness between the organisms and the dissimilarity shows the different course of paths organisms have chosen during the time of evolution. It is said that all organisms somehow evolved from single cells (unicellular) but irrespective of history and evolutionary studies, the diversity we found among organisms makes the ecosystem balance.

- (A) On what basis will the newly found species be classified?
- (a) Morphological basis
  - (b) Mode of reproduction basis
  - (c) Cultural basis
  - (d) Evolutionary basis
- (B) Which system should be followed for naming the new species?
- (a) Conventional nomenclature
  - (b) Polynomial nomenclature
  - (c) Trivial nomenclature
  - (d) Binomial nomenclature
- (C) What is the purpose of introducing a binomial system of classification?
- (D) What are the two parts of a binomial classification?
- (E) Assertion (A): The unicellular organisms are made up of single cells.  
 Reason (R): All the chemical reactions in unicellular organisms are confined in separate compartments.
- (a) Both A and R are true and R is the correct explanation of A.
  - (b) Both A and R are true and R is not the correct explanation of A.
  - (c) A is true but R is false.
  - (d) A is false but R is true.

**Ans. (A)** (d) *Evolutionary basis*

**Explanation:** Evolutionary basis of classification tracks the common ancestry and linkage to understand the phylogenetic relationships among different organisms. The classification based on morphology or characteristics is superficial and the native way of classifying species is not well accepted globally but the evolutionary basis of classification expands the understanding of evolution from the common ancestry and change in traits which came along with evolution and it marks the best method for classifying organisms.

**(B)** (d) *Binomial nomenclature*

**Explanation:** Binomial nomenclature is the modern method of naming organisms in which the name is composed of two names; the first word represents the

genus and the second word represents the specific epithet, giving the unique name to every species.

**(C)** The binomial system of classification was introduced by Carolus Linnaeus to define a common system for naming all the organisms known to us or will be known to us in the future. The binomial system suggests giving two names to all the organisms or species.

**(D)** First word represents the genus and the second word represents the specific epithet.

**(E)** (c) *A is true but R is false.*

**Explanation:** Unicellular organisms are made up of single cells. Thus, all the chemical or metabolic reactions mostly occur in the cytosol. Due to the simple arrangement found in the organisms, there are no separate compartments for efficient functioning.

### TOPIC 3

## THREE DOMAINS OF LIFE

In biological classification, the domain is the highest taxonomic rank on category, above the kingdom level. It was first introduced in the year 1990.

Three domain system of classification was developed by Carl Woese with his colleagues named Otto Kandler and Mark Wheelis.

In this system, all the organisms can be classified into 3 domains on the basis of structure of rRNA, its sensitivity to antibiotic lipid structure of cell membrane.

### Domain Archaea

Organisms with prokaryotic cells are found in this domain. Nuclear membrane is absent. They have bacterial cell RNA markers in them. The name "archaea" comes from an ancient Greek word that means "ancient things," and it refers to the earliest species of life on Earth. They have a unique cell wall that allows them to thrive in severe and harsh environments. Archaea's cell wall is devoid of peptidoglycan.

**Examples:** Methanogens, Halophiles, etc.

### Domain Bacteria

Prokaryotic cells are also present in domain bacteria. They are also referred to as real bacteria or eubacteria. Methanogens, Halophiles etc. Peptidoglycan makes up their cell wall. Unbranched fatty acid chains and glycerol create an ester bond to form their cell membrane.

**Examples:** Cyanobacteria, Eubacteria, etc.

### Domain Eukarya

Organisms with eukaryotic cells and membrane-bound nuclei belong to the domain Eukarya. Cell walls may be present in them. They have a cell wall that is composed of chitin and cellulose. Their cell wall is devoid of peptidoglycans.

Protista, Fungi, Plantae, and Animalia are the four kingdoms that make up the domain Eukarya.

### TOPIC 4

## SYSTEMATICS

The word 'systematics' is derived from the Latin word 'systema' which means the systematic arrangement of the organisms. This field was also introduced by Linnaeus in his book named *Systema Naturae*.

Systematics is a term often used interchangeably with taxonomy. According to Simpson (1961),

systematics is the science that deals with the diversity of organisms and all their comparative, evolutionary relationships and based on a study of comparative anatomy development, comparative ecology, etc.

All the species do share some similarities and differences among them, but what makes them work



together in a habitat or a niche actually is the basis of how the ecosystem works. If the relationship between the species was not important then the removal of one species would not have affected the other, but it is a known fact that if one species is removed then the other is directly or indirectly affected by it.

The human involved extinction or Anthropocene extinction or Holocene extinction are caused due to human activities, which are responsible for causing the extinction or endangerment of numerous species. The self-centred activities of humans have caused numerous problems to the environment and ecosystem which is now globally visible to all and the extinction or removal of any species in the ecosystem is simply causing unnatural changes and damage to other species niches.

#### Example 1.4: Case Based:

*A pond ecosystem was being studied by a student. A pond is home to many fishes and tadpoles. There were plenty of resources present in the pond ecosystem. The small fishes feed on mosses grown on the rocks and swim around the aquatic plants thriving in the ponds. The larger fishes feed on smaller fishes and hence, balance the natural order and ensure continuity of life. Feeding is essential for sustaining life. During an organism's intake of food, the complex food is converted into simpler forms and the nutrients are extracted from it so that the entire cell can derive nutrition from them. The nutrients provide energy for carrying out essential functions of life.*

- (A) If a habitat contains 40 animal species and 40 plant species, it is considered as:
- (a) diversity                      (b) biodiversity  
(c) ecosystem                    (d) population
- (B) Which language should be preferred for naming the species?
- (a) English                      (b) French  
(c) Spanish                      (d) Latin
- (C) What term is used to describe the presence of a variety of organisms in the various habitats on earth?

(D) What is the smallest unit of biological hierarchy in an organism ?

(E) Assertion (A) : *Amoeba* chooses a simple method for reproduction.

Reason (R): The most common mode of reproduction found in *Amoeba* is cell division.

- (a) Both A and R are true and R is the correct explanation of A.  
(b) Both A and R are true and R is not the correct explanation of A.  
(c) A is true but R is false.  
(d) A is false but R is true.

Ans. (A) (b) biodiversity

**Explanation:** If a habitat contains 40 animal species and 40 plant species, it is considered the biodiversity of that given habitat because biodiversity refers to the variation of life forms in a specific area.

(B) (d) Latin

**Explanation:** Dead languages like Latin do not have native speakers and hence naming in Latin do not create any conflict among different language speakers.

(C) Diversity is the term used to describe the collection of various organisms in different habitats on earth.

(D) Cell is the smallest unit in a biological hierarchy as all multicellular and complex organisms are made up of cells only.

(E) (a) Both A and R are true and R is the correct explanation of A.

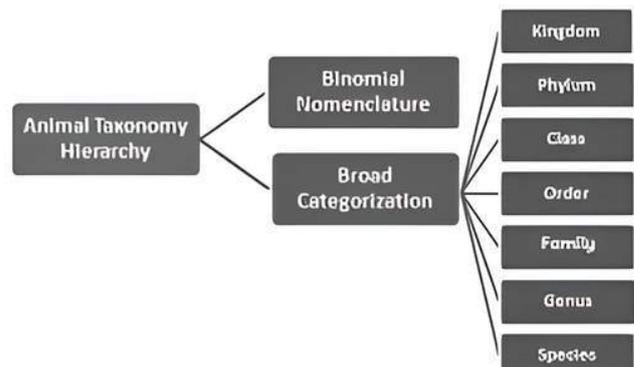
**Explanation:** Cell division is the simplest way of reproduction. In cell division, one cell divides into two daughter cells and most unicellular organisms like *Amoeba* chooses cell division to reproduce.

## TOPIC 5

### TAXONOMY AND ITS CATEGORIES

#### Taxonomy

Society functions on a hierarchy and so does biology. All the organisms on the planet are divided into certain groups and divisions ranging from higher to lower. The lowest ranking (species) shares the most common features than the highest ranking (kingdom) in the hierarchy so that the entire arrangement is maintained within the ecosystem. A field was discovered by Carolus Linnaeus to extensively study the nomenclature and characterisation of species called Taxonomy, although the word itself was coined by A.P de Candolle.

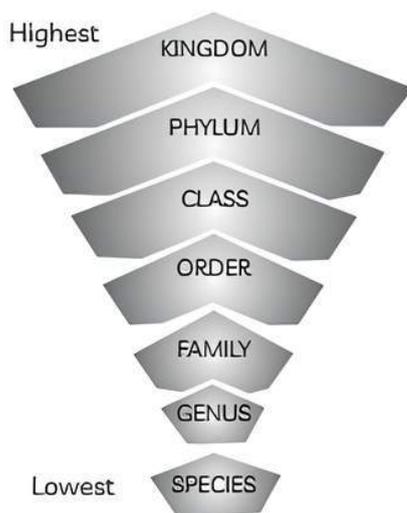


## Taxonomic Hierarchy

Each category is called taxa. All the organisms are categorised on the basis of their characters and are arranged in taxonomic hierarchy. Each category is called a taxonomic category or unit of classification and is commonly referred to as rank or taxon.

The taxonomic hierarchy in descending order is:

- (1) Kingdom
- (2) Phylum or division (for plants)
- (3) Class      (4) Order
- (5) Family    (6) Genus
- (7) Species



Hierarchy of biological classification

## Species

Species is a group of actually or potentially interbreeding populations that are reproductively isolated from other such groups. The species are named on the basis of binomial nomenclature.

**For example:** Let us consider *Mangifera indica* (Mango), *Solanum tuberosum* (Potato), *Panthera leo* (Lion) and *Homo sapiens* (Human beings). In all these names, *indica*, *tuberosum*, *leo* and *sapiens* represent the specific epithets.

## Genus

These are the related species sharing some more common characteristics. There are certain species with a common genus like lion (*Panthera leo*), leopard (*P. pardus*) and tiger (*P. tigris*) have common genus named *Panthera*.

## Family

Family includes some related genera with few similar characteristics, e.g., *Solanum*, *Petunia* and *Datura* belong to the Family Solanaceae. Similarly, *Panthera* and *Felis* (cats) belong to the Family Felidae.

## Order

It is a higher taxonomic category which includes families sharing some of the common features.

**Examples:**

- (1) Plant families such as Convolvulaceae and Solanaceae belong to the Order Polymoniales.

- (2) Animal families such as Felidae and Canidae are included in the Order Carnivora.

## Class

The organisms belonging to the related orders are included in it. For example, Order Primata and Order Carnivora are placed in Class Mammalia.

## Phylum or Division

It is a category higher than that of class. The term phylum is used for animals while division is used for plants. A division or phylum is formed of one or more classes.

**Examples:** The Phylum Chordata of animals contains not only the Class Mammalia but also aves (birds), reptilia (reptiles), amphibia, Cyclostomata, Chondrichthyes, Osteichthyes (fishes), etc.

## Kingdom

It is the highest category in which all the animals are included under Kingdom Animalia while all the plants are included in Kingdom Plantae.

**Example 1.5:** Define a taxon. Give some examples of taxa at different hierarchical levels. [NCERT]

**Ans.** Taxon refers to a taxonomic category which includes certain organisms in a category based on some similarities. Eg., Class, Order, Family, etc.

**Example 1.6:** Illustrate the taxonomic hierarchy with suitable examples of a plant and an animal.

**Ans.** (1) The taxonomic hierarchy of Rose:

Kingdom - Plantae, Order - Rosales,  
Family - Rosaceae, Genus - *Rosa*,  
Species - *indica*

(2) The taxonomic hierarchy of human:

Kingdom - Animalia, Order - Primates,  
Family - Hominidae, Genus - *Homo*,  
Species - *sapiens*

**Example 1.7:** Can you identify the correct sequence of taxonomic categories?

(a) Species → Order → Phylum → Kingdom

(b) Genus → Species → Order → Kingdom

(c) Species → Genus → Order → Phylum

(d) Both (a) and (c) [NCERT]

**Ans.** (d) Both (a) and (c)

**Explanation:** Both (a) and (c) represent correct sequences of taxonomic categories as the correct hierarchical arrangement of taxonomic categories in ascending order is:

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

In sequence (b), the species should have been followed by genus. Therefore, it does not represent the correct sequence.



# OBJECTIVE Type Questions

[ 1 mark ]

## Multiple Choice Questions

1. Organisms belonging to a defined group called genus signify:

- (a) an individual plant or animal
- (b) a collection of plants or animals
- (c) a group of closely related species of plants or animals
- (d) none of the above [NCERT Exemplar]

Ans. (c) a group of closely related species of plants or animals

**Explanation:** A genus name may be shared by different species but the organisms belonging to the same genus share many common characteristics which make them suitable to be grouped together.

2. The explicit characteristic of microorganisms is defined by:

- (a) metabolism
- (b) sexual reproduction
- (c) growth
- (d) asexual reproduction

Ans. (d) asexual reproduction

**Explanation:** Metabolism and growth are the common characteristics of any living organism whereas sexual reproduction is the general mode of reproduction in complex organisms such as multicellular organisms like humans but asexual mode of reproduction is primitive and prominently found in simpler life forms like microorganisms.

3. The characteristic that is common to plants but not to animals is:

- (a) metabolism
- (b) autotrophy
- (c) sexual reproduction
- (d) asexual reproduction

Ans. (b) autotrophy

**Explanation:** Autotrophy is the process of making food using inorganic compounds in the presence of sunlight through the process of photosynthesis.

4. Statement A: Taxa cannot indicate categories at different levels.

Statement B: Dog is a mammal and mammals are animals but 'animals', 'mammal', 'dog' can represent taxa at different levels.

- (a) Both A and B are correct.
- (b) Both A and B are incorrect.
- (c) Only A is correct.
- (d) Only B is correct.

Ans. (d) Only B is correct.

**Explanation:** Each classification unit or category is referred to as a taxon. In ascending order, the basic level of classification is species, followed by genus, family, order, class, phylum, or division. As a result, animals, dogs, and mammals represent taxa at various levels.

5. The category sharing the least similar characteristics among the following is:

- (a) Species
- (b) Class
- (c) Order
- (d) Family

Ans. (b) Class

**Explanation:** Class includes the organisms with few characteristics in similarity in comparison to Order, Family and Species.

6. The term 'systematics' was coined by which researcher?

- (a) John Ray
- (b) Carolus Linnaeus
- (c) Julian Huxley
- (d) Charles Darwin

[Diksha]

Ans. (b) Carolus Linnaeus

**Explanation:** Carolus Linnaeus was the one who coined the term 'systematics' and introduced the classification of hierarchy and is considered the 'Father of Taxonomy'.

7. Choose the odd one out of the following options.

- (a) *Solanum*
- (b) *Petunia*
- (c) *Datura*
- (d) Solanaceae

Ans. (d) Solanaceae

**Explanation:** Solanaceae is a family whereas *Solanum*, *Petunia* and *Datura* are names of the genus.

8. Which taxonomic category is specifically defined for plants and not for other organisms?

- (a) Kingdom
- (b) Phylum
- (c) Division
- (d) Class

Ans. (c) Division

**Explanation:** Phylum and Division are the same taxonomic category but division is used as a taxonomic group for plants.

9. What scientific name is used to define cats in the scientific community?



- (a) *Panthera leo*
- (b) *Panthera pardus*
- (c) *Panthera tigris*
- (d) None of the above

Ans. (d) None of the above

**Explanation:** The general genus for cats is *Felis* and the genus *Panthera* includes lion (*Panthera leo*), leopard (*Panthera Pardus*), tiger (*Panthera tigris*), etc.

10. Match the following.

Column I	Column II
(A) Family	(i) <i>tuberosum</i>
(B) Kingdom	(ii) Polymoniales
(C) Order	(iii) <i>Solanum</i>
(D) Species	(iv) Plantae
(E) Genus	(v) Solanaceae

- (a) A-(iv), B-(v), C- (iii), D- (ii), E- (i)
- (b) A-(v), B-(iv), C- (ii), D- (i), E- (iii)
- (c) A-(v), B-(iv), C- (iii), D- (i), E- (ii)
- (d) A-(ii), B-(i), C- (iv), D- (iii), E- (v)

Ans. (b) A-(v), B-(iv), C- (ii), D- (i), E- (iii)

**Explanation:** Family- Solanaceae, Kingdom- Plantae, Order- Polymoniales, Species- *tuberosum*, Genus- *Solanum*.

11. What is the common method of reproduction found in *Hydra*?

- (a) Cell division
- (b) Fragmentation
- (c) Budding
- (d) Sexual reproduction

Ans. (c) Budding

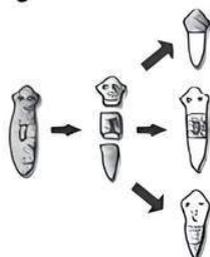
**Explanation:** Reproduction through budding takes place when an outgrowth in the body is developed due to repetitive cell division and it grows and detaches itself so that the new bud can be developed into a new *Hydra*.



### Caution

Students should know that *Hydra* can also reproduce sexually but only in unfavorable conditions. If asked about a common method of reproduction in *Hydra*, the answer will be budding.

12. The following organism goes through an injury and it grows as shown:



Among the options mentioned below, which organism is found with the highest possibility of surviving after an injury?

- (a) Frog
- (b) Fish
- (c) Plant
- (d) *Planaria*

Ans. (d) *Planaria*

**Explanation:** *Planaria* can reproduce through the process of fragmentation. The organism shown in the above figure is also *Planaria*. Each fragment is capable of growing into a new *Planaria* so if any injury takes place and even if results in the dividing or fragmenting of the *Planaria*'s body, then *Planaria* can survive.

13. All the chemical reactions inside the human body are needed for energy production. What chemical reactions are involved in energy release?

- (a) Anabolic reactions
- (b) Catabolic reactions
- (c) Metabolic reactions
- (d) All of the above

Ans. (b) Catabolic reactions

**Explanation:** Catabolic reactions are involved in breaking down complex substances and biomolecules by breaking the bonds present in them. The breaking of bonds releases the energy.

14. Statement A: Species included in a genus resemble the least features.

Statement B: All species in a genus have a common ancestry.

- (a) Both A and B are correct.
- (b) Both A and B are incorrect.
- (c) Only A is correct.
- (d) Only B is correct.

Ans. (d) Only B is correct.

**Explanation:** Species is the lowest level of classification and is regarded as the fundamental unit of classification. It is a group of similar individuals who share morphology and are capable of interbreeding. A genus is a group of closely related species that share a common ancestor.

15. A student wanted to keep a pet rat. He kept it inside a closed cage and found that the rat died the next day. Select the reason behind the death of the rat.

- (a) It did not get the space to move.
- (b) It did not get sunlight to grow.
- (c) It did not get air to breathe.
- (d) It did not get food to eat.

Ans. (c) It did not get air to breathe.

**Explanation:** A rat can live without space to move, sunlight or food for a few days. But the rat couldn't survive because of the lack of air to breathe.

## Assertion-Reason (A-R)

Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

**16. Assertion (A) :** *Planaria* reproduces by the process of fragmentation.

**Reason (R) :** The body of *Planaria* is fragmented into different parts and each part can be grown into new *Planaria*.

**Ans.** (a) Both A and R are true and R is the correct explanation of A.

**Explanation:** *Planaria* body can be divided into different parts by physical division or any other way and parts are called fragments. Each fragment is capable of developing into new *Planaria* and the process is called fragmentation or true regeneration.

**17. Assertion (A) :** Organisms are divided into distinct taxonomic categories.

**Reason (R) :** Higher the taxonomic category, the more similarities are present within the organisms.

**Ans.** (c) A is true but R is false.

**Explanation:** All living organisms are divided into various taxonomic categories or taxon and the higher the taxonomic category, the fewer the similarities shared among organisms. Organisms are divided into distinct taxonomic categories to study the various living organisms and the relations between them.

- 18.** There are millions of living organisms on earth. All these living organisms differ in shape, size, colour, habitat and many other characteristics. To understand their origin, diversity, distribution and inter relationship, the scientists have devised mechanisms to classify all of them.



**Assertion (A):** The term systematics refers to the diversity of different kinds of organisms and their relationship.

**Reason (R):** Systematics deals with the identification, naming and classification of the organisms into groups.

**Ans.** (a) Both A and R are true and R is the correct explanation of A.

**Explanation:** Systematics is the scientific study of the diversity of different kinds of organisms and their relationships to each other. It encompasses the identification, classification, and naming of organisms, as well as the study of their evolutionary relationships and patterns of distribution. Therefore, the statement that "Systematics deals with the identification, naming and classification of the organisms into groups" is a correct explanation of the assertion that "The term systematics refers to the diversity of different kinds of organisms and their relationship."

## CASE BASED Questions (CBQs)

[ 4 & 5 marks ]

Read the following passages and answer the questions that follow:

**19.** Taxonomy and systematics are branches of science that include the study of the classification, nomenclature, identification, and evolutionary history of an organism. Thus, the taxonomic characteristics of an organism along with its evolutionary history come under systematics. In 1913, A.P. de Candolle was the first to introduce the term taxonomy while systematics was introduced during the time of human civilisation.

The term systematics is derived from the Latin word 'systema' which means the systematic arrangement of organisms. Linnaeus (father of taxonomy) published his book *Systema Naturae* where the classification of plants and animals was based on taxonomy.

In 1940, Julia Huxley was the one who developed the concept of neo-systematics. It involves the known characteristics of an organism and also the known evidence from different fields of biology.

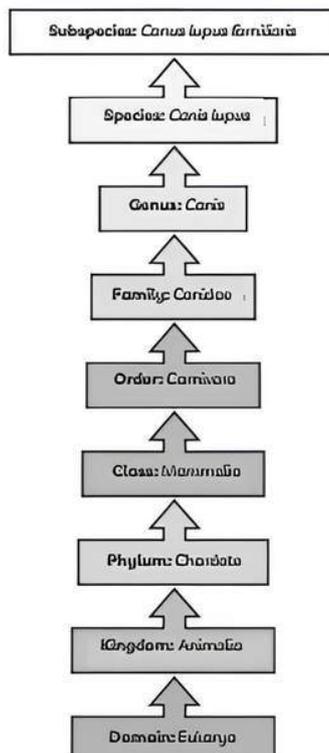
- (A) What are the basis of modern taxonomical studies?
- (B) Who is the father of taxonomy?
- (C) What do we call the organising of taxonomic information in logical classification?

**Ans.** (A) The basis of modern taxonomical studies are external and internal structure, structure of cell, development process and ecological information.

(B) Carolus Linnaeus.

(C) Systematics is the process where taxonomic information of organisms is organized into a logical framework. Taxonomy and systematics are together referred to as systematic biology.

**20.** Classification involves hierarchy of steps in which each step represents taxonomic category. Each taxonomic category is referred to as a unit of classification and is commonly termed as taxon. Taxonomic hierarchy is a system of arranging all taxonomic categories in descending order with kingdom at the top and species at the base. As we go up the taxonomic hierarchy, the number of individuals' increases but the number of common characteristics goes on decreasing.



- (A) Modern classification is based on:
  - (a) Fossils
  - (b) Taxonomy
  - (c) Morphology
  - (d) Phylogeny
- (B) A scientist who made significant contribution of field of classification is:
  - (a) Pasteur
  - (b) Darwin
  - (c) Oparin
  - (d) Linnaeus
- (C) If two organisms are in the same phylum, then the two organisms belong to the same:
  - (a) Class
  - (b) Order
  - (c) Kingdom
  - (d) Species
- (D) Assertion (A): Taxonomic hierarchy is the unit of classification that arranges all the taxonomic categories.

**Reason (R):** Taxonomic hierarchy is the arrangement of all taxonomic categories in descending order from kingdom to species.

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.
- (E) Choose the correct statement.
  - (a) Taxonomy is the study of diversity of organisms and all their comparative and evolutionary relationships.
  - (b) Taxonomy is the study of organisms on the basis of their characteristics.
  - (c) Taxonomy deals with comparative anatomy, ecology, physiology, phylogenetics and biochemistry.
  - (d) Both (a) and (c)

**Ans.** (A) (d) Phylogeny

**Explanation:** Modern classification is based on Phylogeny. Phylogeny is the history of the evolution of a species or group, mainly in reference to lines of descent and relationships among broad groups of organisms.

(B) (d) Linnaeus

**Explanation:** Carolus Linnaeus introduced a binomial system of nomenclature. He gave two names to a species—One is a generic name while the other is a specific name.

(C) (c) Kingdom

**Explanation:** If two organisms are in the same phylum, then it means they both belong to the same kingdom, because kingdom is the rank of classification higher than phylum.

- (D) (a) Both A and R are true and R is the correct explanation of A.

**Explanation:** The assertion "Taxonomic hierarchy is the unit of classification that arrange all the taxonomic categories" is true. The taxonomic hierarchy is a system of classification that arranges all taxonomic categories in a specific order, with kingdom at the top and species at the base. This is a unit of classification because it is a way of grouping and organising different organisms into categories based on shared characteristics. The reason "Taxonomic hierarchy is the arrangement of all taxonomic categories in descending order from kingdom to species" is also true

and correctly explains the assertion. The taxonomic hierarchy does indeed arrange all taxonomic categories in a descending order, with kingdom at the top and species at the base.

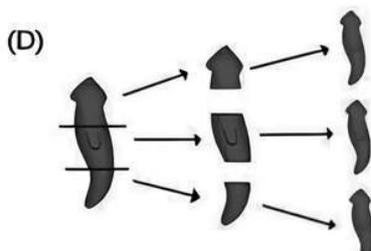
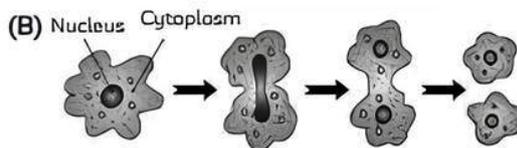
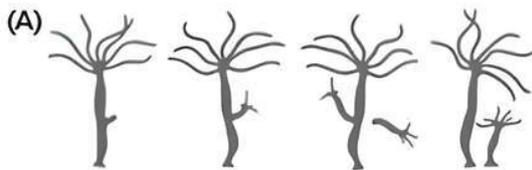
- (E) (b) *Taxonomy is the study of organisms on the basis of their characteristics.*

**Explanation:** It is the study of organisms on the basis of their characteristics. It includes morphological and anatomical features for identification. Systematics is the study of diversity of organisms and all their comparative and evolutionary relationships. It deals with comparative anatomy, ecology, physiology, phylogenetics and biochemistry.

## VERY SHORT ANSWER Type Questions (VSA)

[ 1 mark ]

21. The following given modes of reproduction belong to which organism? Explain briefly.



- Ans.** Figure (A) represents *Hydra* which reproduces through the process of budding.

Figure (B) represents *Amoeba* which reproduce through binary fission.

Figure (C) represents Fungi which reproduces through spores.

Figure (D) represents *Planaria* which reproduces by the process of regeneration.

22. Is there any scientific name for the human community?

**Ans.** Yes, the scientific name for humans is *Homo sapiens*.

23. The word 'species' is used extensively in biology. How can you define the term species?

**Ans.** The group of living organisms sharing certain fundamental similarities are called species.

24. An organism ensures that its species do not disappear from the earth through the process of reproduction. Define the process of reproduction.

**Ans.** The ability to create new progenies is called reproduction. Reproduction is defined as a biological process in which an organism gives rise to offsprings.

25. Growth of living organisms is one of the characteristic features shared by all living beings. How is it relevant to microorganisms?

**Ans.** The microorganisms show growth by an increase in number of cells through cell division.

26. In the field of science, the nomenclature is an obligatory study for studying organisms which are articulated to define in what way?

**Ans.** It is the process of naming living organisms so that they can be known by a single Identity all over the world.

**27. How can you define taxon?**

**Ans.** Each taxonomic category contains a certain group of organisms which are referred to as taxon.

**28. State one difference between flora and fauna.**

**Ans.** Flora is the term used to describe the total number of plants found in a particular area at a particular time.

Fauna is the term used to describe the total number of animals found in a specific region at a particular time.

**29. The nomenclature codes for animals are determined by which set of rules?**

**Ans.** International Code of Zoological Nomenclature (ICZN).

**30. The nomenclature codes for plants are determined by which set of rules?**

**Ans.** International Code for Botanical Nomenclature (ICBN)

**31. The ranking system determining the importance and variety among the**

organisms causes the proper endurance to study and research various living beings. What is the term used for the system of ranking in such a specific manner?

**Ans.** Hierarchy.

**32. The cell is the basic unit of life but what is the living matter and aqueous part in the cell called?**

**Ans.** Protoplasm is the living matter and the aqueous part of the cell is called cytoplasm.



### Related Theory

~ *Cytoplasm is the place where all the organelles are present. Similarly, the nucleus contains the nucleoplasm excluding the nuclear envelope. The cytoplasm and nucleoplasm together constitute protoplasm, the living matter of cells.*

**33. If an organism is discovered dissimilar to all the existing species known to us. Where do newly found organisms find their place in the hierarchical system of classification for study and research?**

**Ans.** A new taxon will be designed for the new organism.

## SHORT ANSWER Type-I Questions (SA-I)

[ 2 marks ]

**34. Name the three domains of the classification system and state the characteristics of each of them.**

**Ans.** The three domains are the Archaea, the Bacteria, and the Eukarya.

**Characteristics of archaea:**

- (1) Archaea are prokaryotic cells.
- (2) The cell walls of Archaea contain no peptidoglycan.

**Characteristics of bacteria:**

- (1) Bacteria are prokaryotic cells.
- (2) The cell walls of Bacteria, unlike the Archaea and the Eukarya, contain peptidoglycan.

**Characteristics of eukarya:**

- (1) Eukarya have eukaryotic cells.
- (2) Not all Eukarya possess cells with a cell wall, but for those Eukarya having a cell wall, that wall contains no peptidoglycan.

**35. Discuss the advantages of assigning a scientific name to a living organism.**

[Delhi Gov. QB 2022]

**Ans.** The scientific name ensures that each organism has only one name. Description of any organism should enable the person to arrive at the same name. They also ensure that such a name has not been used for any other known organism.

## SHORT ANSWER Type-II Questions (SA-II)

[ 3 marks ]

**36. The number and kinds of organisms are not constant. How do you explain this statement? [NCERT Exemplar]**

**Ans.** In respect to the number of organisms, the population of any species of organism is not constant. The population tends to change in

accordance with the conditions such as area, region, geography and climate.

If the conditions are favourable, then the population grows else the population reduces. As well as, organisms keep on reproducing which affects the population.



The kinds of organisms we have gathered from ancient times to the modern world have changed from an inevitable phenomenon called evolution which makes it impossible for kinds of organisms to remain the same as it was in the past and will be in the forthcoming future.

**37. What are the rules of binomial nomenclature?**

**Ans.** The rules of binomial nomenclature are as follows:

- (1) The biological name generally originated from Latin.
- (2) The biological name when printed is written in italics and if hand-written is underlined separately.
- (3) The first name represents the genus and the second name represents the specific epithet.

(4) The first name starts with a capital letter and the second name starts with a small letter.

**38. A plant species shows several morphological variations in response to the altitudinal gradient. When grown under similar conditions of growth, the morphological variations disappear and all the variants have common morphology. What are these variants called? [Diksha]**

**Ans.** These variants are called biotypes. All biotypes are similar genetically but they are different morphologically. The morphological difference happens because of the differences in abiotic factors like temperature, pH of soil, climates, etc. The difference in abiotic factors is the result of different altitudinal gradients.

## LONG ANSWER Type Questions (LA)

[ 4 & 5 marks ]

**39. Some of the properties of tissues are not features of their constituent cells. Give three examples to support the statement.**

**Ans.** The cells interact with one another and certain properties as tissue are enlightened which are not present in the case of a single cell. Their properties are important to communicate between cells, transporting vital information in the form of biomolecules or biosignaling molecules, transporting nutrients for survival, etc. Three examples that support the statement are as follows:

- (1) The muscle tissue contracts and relaxes when it causes a movement which is not an exclusive property of the cell. Contraction and relaxation are important for body movement and the muscle tissue interacting with muscle cells perform this function but a single muscle cell is not capable of performing it.
- (2) All the cells in the body are similar yet they perform different functions when present in different tissues or organs. The cells of bone are hard and the deposition of minerals causes calcification which makes its appearance and physical character hard and tough but cartilage tissue is soft.
- (3) Blood is a very vital tissue which has a very important function of transportation, especially gases. It is the blood which carries oxygen to different body cells but the cells in the blood like white blood cells do not have any function related to the transportation of gases or anything else.

So, the properties of the tissues develop due to interaction and coordination between the cells of the same tissue.

**40. Illustrate taxonomical hierarchy with suitable examples from plant and animal species. [Delhi Gov. QB 2022]**

**Ans.** The arrangement of different taxa in a hierarchical order is known as a taxonomic hierarchy.

In this hierarchy, species is present at the lowest level whereas kingdom is present at the highest level.

**Taxonomical hierarchy of a plant:**

For example: *Solanum nigrum*

Kingdom – Plantae

Division – Angiospermae

Class – Dicotyledonae

Order – Solanales

Family – Solanaceae

Genus – *Solanum*

Species – *nigrum*

**Taxonomical hierarchy of an animal:**

For example: *Homo sapiens*

Kingdom – Animalia

Phylum – Chordata

Class – Mammalia

Order – Primate

Family – Hominidae

Genus – *Homo*

Species – *sapiens*

