The Living World

Ernst Mayr
(1904-2004)

Born on 5 July 1904, in Kempten, Germany, ERNST MAYR, the Harvard University evolutionary biologist who has been called **'The Darwin of the 20th century',** was one of the 100 greatest scientists of all time. Mayr joined Harvard's Faculty of Arts and Sciences in 1953 and retired in 1975, assuming the title **"Alexander Agassiz Professor of Zoology Emeritus".** Throughout his nearly 80-year career, his research spanned ornithology, taxonomy, zoogeography, evolution, systematics, and the history and philosophy of biology. He almost single-handedly made the origin of species diversity the central question of evolutionary biology that it is today. He also pioneered the currently accepted definition of a biological species. Mayr was awarded the three prizes widely regarded as the **triple crown of biology: the Balzan Prize** in 1983, **the International Prize for Biology in 1994**, and **the Crafoord Prize in 1999.** Mayr died at the age of 100 in the year 2004.

Introduction

Biology; (Bios = Life, Logos = Study/discourse;) means study of life is biology.

- **'Biology** is the science of life forms and living processes".
- **"Biology** is the story of life on earth"
- **"Biology** is the story of evolution of living organisms on earth"

Characteristics of Living Organisms:

1. Growth
2. Reproduction
3. Metabolism
4. Cellular Organisation
5. Consciousness

1. Growth:

- Growth is Increase in mass or volume or number.
- Growth is of two types:
  (a) **Intrinsic growth**: This growth is from inside of the body of living organisms.
  (b) **Extrinsic growth**: This growth is from outside i.e. accumulation of material on any body surface. Non living exhibits this type of growth. e.g. rusting of iron, increase in size of glacier etc.

- **Intrinsic growth is of two types:**
  (a) **Indeterminate growth**: Unlimited growth. Growth which occurs continuously throughout their life span is indeterminate growth or unlimited growth. It occurs in plants .
  (b) **Determinate growth:** Limited growth → Growth which occurs only upto a certain age is determinate growth or limited growth. It occurs in animals.
- In majority of higher plants and animals, growth and reproduction are mutually exclusive events.
- Because both living and non-living exhibit growth so it can not be taken as **defining property** of living organism.

2. Reproduction:

It is a biological process by which an individual produce offspring which is similar or almost similar to the parental organism.

- Reproduction in case of unicellular organisms like bacteria, unicellular algae or Amoeba is increase in number of cells. In unicellular organisms the growth and reproduction are mutually not exclusive event.
- Non living object never reproduce.
- There are many living organisms which can/do not reproduce like mules, sterile human couples, worker bees.
- So the reproduction can not be taken as **defining characteristic** of living organisms also .

Reproduction is of two types

(A) Asexual Reproduction: Reproduction in which gametic fusion or fertilisation and meiosis are not involved. Asexual reproduction occurs by many methods e.g.

(a) By Asexual spores: In algae and fungi
(b) By Budding: In Yeast and Hydra
(c) By Fragmentation: In Filamentous algae, fungi and the protonema of moss plants
(d) True Regeneration (Morphallaxis type): Fragmented organisms regenerate the lost part of its body and become a new organism. e.g. Planaria

(B) Sexual Reproduction: Reproduction in which Gametogenesis and fusion of gametes occurs.

3. Metabolism

- The sum total of all the chemical reactions occuring in our body is metabolism.
- All living organisms, both unicellular and multicellular exhibit metabolism.
- Non-living object does not show metabolism.
- Thus metabolism is a **defining character** of living organisms.
- Metabolic reaction can also occurs outside cell or body. These isolated metabolic reaction outside the body of an organism, performed in a test tube (in-vitro) is **neither living nor non-living**.
- These isolated reactions can not be regarded as living things, but they are definitely living reactions because they are similar to the reactions performing in our body.

4. Cellular Organisation:

- Cell is the basic unit of life.
- Body of all the living organism is made up of cell.
- Unicellular organisms are capable of independent existence and performing essential functions of life.
- Anything less than a complete structure of a cell, does not ensure independent living. Hence, cell is the fundamental structural and functional unit of all living organisms.
- Cellular organisation is also **defining properties** of living organism

5. Consciousness:

- Ability to sense the surrounding environments and respond to these environmental stimuli is called as consciousness.
- Consciousness is the most important **defining feature** of all living organisms.
- We sense these physical, chemical or biological stimuli through our sense organs.
- Plants also sense and respond to external factors like light, water, temperature, other organisms, pollutants etc.
- All organisms from the prokaryotes to complex eukaryotes show consciousness to environment.
- Some common examples of consciousness can be seen in organisms, like - Plants performs flowering in a particular season (photoperiodism), Some animals perform breeding in a particular season only (seasonal breeders), and all organisms handle the chemicals entering their bodies etc.
- Human being also show **self consciousness**
- Due to the self consciousness human is the **most dominants organism** on earth

- **So we can say that a living organism is self replicating, self evolving interactive system which is capable to show response against stimulus.**
- Properties of tissue, organ or cell is not present in their constituents but they are emerged due to interaction among their constituents. All the living phenomena are due to underlying interactions between different components of an individual
- All the living organism present on earth are related to each other by sharing a common genetric material which show similarity at varying degree.

Note:

- The brain dead coma patient who is supported by machine which replaces heart and lungs, also has consciousness so it is living but it does not has self consciousness because it has lost the co-ordination of organs of different body part.

Concept Builder

1. Metabolism is exhibited by:
(1) All plants (2) All animals (3) Fungi & Microbes (4) All of these

2. Which of the following is **not** the defining property of living ?
(1) Consciousness (2) Reproduction (3) Growth (intrinsic) (4) Metabolism

3. In higher plants & animals, growth & reproduction are linked but are
(1) Mutually exclusive events
(2) Mutually inclusive events
(3) Mutually inclusive events along with monerans
(4) Mutually exclusive events along with protistans

4. Which of the following is **not** applicable to living organisms?
(1) These are self replicating and evolving system
(2) These are self replicating and capable of responding to external stimuli
(3) These are self replicating and non-regulating interactive system
(4) They exhibits metabolism

5. Most obvious and technically complicated feature of all living organisms is
(1) Metabolism (2) Cellular organisation
(3) Growth (4) Consciousness

6. Number of known species of earth is
(1) 1.6 to 2.7 billions (2) 1.7 to 1.8 millions
(3) 1.6 to 1.7 thousands (4) 1.6 to 1.7 crores

Concept Builder (Answer-Key)						
Que.	**1**	**2**	**3**	**4**	**5**	**6**
Ans.	4	2	1	3	4	2

Diversity in living word

Biodiversity is the number and various kind of organism present on earth. Diversity differ from place to place. So, when we explore new areas or even old areas new species are found.

According to IUCN

Total number of known species = 1.7 to 1.8 million

Animal species 1.2 million

Plant species 0.5 to 0.6 million

Do You Know?

- Maximum diversity in animal kingdom is present in **arthropoda**
- Maximum diversity in plant kingdom is present in **Angiosperm than fungi**
- Maximum diversity is found in **tropical rain forests.**
- Second maximum diversity is found in **coral reefs**

Taxonomy

Taxonomy (Taxis = arrangement, nomos = law $\rightarrow$) is the study of principles and procedures of classification.

This word was proposed by **A.P. de. Candolle** in his book **'Theories elementaire de la botanique** "(Theory' of elementary botany)

Act of Taxonomy:

(1) Characterization: Determination of set of character for identification of a particular organism

(2) Identification: A process by which an organism is recognised from the others by a particular set of character from already known organism.

(3) Nomenclature: Naming of organism according to international scientific rules is called nomenclature.

(4) Classification: A process by which any organism is grouped into convenient categories on the basis of some easily observable characters.

Systematics:

- The term **"Systematics"** was proposed by **Linnaeus.** The word systematics is derived from the latin word "systema" which means systematic arrangement of organisms.

Note:

- It includes description of external morphological characters of plants or living organisms.
  e.g. Morphological characters of Root, Stem, Leaves, Flowers

New systematics or Neo systematics:

(1) Neo-systematics (A new branch) Name given by **Julian Huxley** (1940)

(2) It includes description of organism on the basis of all external and internal structure, along with the structure of cell, development processes and ecological information of organism.

(3) It is used to know the inter relationship among living organism.

- New systematics is mainly based on evolutionary as well as genetic relationship (experimental taxonomy) as compared to morphological characters.

Nomenclature

Binomial system:

- Given by **Carolus Linnaeus**
- Carolus Linnaeus: Linnaeus used this nomenclature system for the first time on large scale and proposed scientific name of all the known plants and animals.
- Linnaeus is the founder of binomial system.
- Linnaeus proposed scientific name of plants in his book "**Species plantarum**". It was published on **1 May 1753**. So this was the initiation of binomial system for plants. So any name proposed for plants before this date is not accepted today.
- Linnaeus proposed scientific name of animals in his book "**Systema Naturae" (10th edition).**
- This 10th edition of Systema naturae was published on **1 August 1758**. So initiation of binomial system for animals is believed to be started on **1 Aug, 1758.**

Binomial Names are Based on ICBN:

"international Code of Botanical Nomenclature"

- Collection of rules regarding scientific nomenclature of plants is known as ICBN.
- ICBN was first accepted in 1961.

Main Rules:

(1) According to binomial system name of any species consists of two components or words -
(i) Name of genus
(ii) Specific epithet

e.g.

Solanum	*tuberosum*(Potato)	*Mangifera*	*indica* (Mango)
↓	↓	↓	↓
Generic name	Specific epithet	Generic name	Specific epithet

(2) First letter of generic name should be in capital letter and first letter of specific epithet should be in small letter. *e.g. Mangifera indica*

(3) When written with free hand or typed, then generic name and specific epithet should be underlined separately. But during printing name should be in italics to indicate their latin origin.

(4) Name of the scientist who proposed nomenclature should be written in short after the specific epithet
e.g. Mangifera indica Linn.

(5) Name of scientist should be neither underlined nor in italics but written in Roman letters (simple alphabets)

(6) Scientific names should be derived from Latin (usually) or Greek languages because they are dead languages.

(7) In plant nomenclature tautonyms are not valid i.e. generic name and specific epithet should not be same in plants *e.g. Mangifera mangifera* is not correct.
But tautonyms are valid in animal nomenclature (ICZN-lnternational Code of Zoological Nomenclature) e.g. *Naja naja* (Indian cobra), *Rattus rattus* (Rat)

(8) Type specimen (Herbarium Sheet) of newly discovered plant should be placed in herbarium (Dry garden).

Trinomial Nomenclature:

- According to this system name of any organism is composed of three words -
  (i) Generic name (ii) Specific epithet (iii) Subspecific epithet (Name of variety)

  e.g.

Brassica	oleracea	botrytis (Cauliflower)
Brassica	oleracea	capitate (Cabbage)
Brassica	oleracea	caulorapa (Knol-Khol)
Generic Name	Specific	Variety

Concept Builder

1. In Binomial Nomenclature,
(1) Genus name is written after species
(2) Genus and species names are written in italics.
(3) Genus and species have the same name
(4) The first letter of genus and species name is capital.

2. The standard name of any living organism is known by the same name all over the world is called:
(1) Nomenclature (2) Taxonomy (3) Classification (4) Description

3. The scientific naming system of two words was first used by
(1) Aristotle (2) C. Linnaeus
(3) Benthem and Hooker (4) Theophrastus

4. The process by which any thing is grouped into convenient categories based on some easily observable characters is called:
(1) Identification (2) Systematic (3) Classification (4) Nomenclature

5. Select the **correct** statement for taxonomic key
(1) It is generally analytical in nature.
(2) Used for identification of plants only
(3) There is same taxonomic key for each taxonomic category.
(4) Term 'Taxonomic key' was coined by Julian Huxley.

6. Systematics was first time proposed by
(1) C. Linnaeus in Pinax (2) Casper Bauhin in Pinax
(3) Casper Bauhin in Species Plantarum (4) C. Linnaeus in *Systerma Naturae*

Concept Builder (Answer-Key)						
Que.	**1**	**2**	**3**	**4**	**5**	**6**
Ans.	2	1	2	3	1	4

Taxonomic Categories

- Classification is not a single step process but involves heirarchy of steps in which each step represent a rank or category.
- Since the category is a part of overall taxonomic arrangement, it is called the taxonomic category and all categories together constitute the taxonomic hierarchy.
- Each category referred to as a unit of classification, infect, represents a rank and is commonly termed as taxon (Plural taxa)

- **Species:** Species is a group of individual which show a common set of characters and can be distinguished from the other closely related species based on the distinct morphological differences.

Smallest Taxonomic Category. It is **Basic Unit of Classification:**

- **Genus:** Genus comprises a group of related species which has more characters in common in comparison to species of other genera.
  e.g. Potato and brinjal are two different species but both belong to the genus ***Solanum.***
  Lion (*Panthera leo*), tiger (*Penthera Tigris*), and leopard (*Penthera Pardus*) belongs to same genus

- **Family:** Family has a group of related genera with still less number of similarities as compared to genus and species. Families are characterised on the basis of both vegetative and reproductive features of plant species but reproductive or sexual or floral characters are used mainly.
  e.g. Three different genera ***Solanum, Petunia*** and ***Datura*** are included in family Solanaceae. Lion, tiger, leopard & cat belongs to same family **Felidae**.

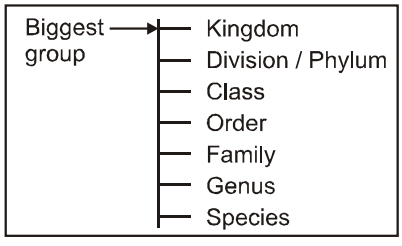
- **Order:** Order being a higher category is the assemblage of families which exhibit a few similar character.
  e.g. Plant families like **Convolvulaceae, Solanaceae** are included in the order **Polynomials which is mainly based on the floral or reproductive or sexual characters.**
  Animal family Canidae & Felidae are included in order Carnivora

- **Class:** Class includes organism of related orders having less similarities than orders.

- **Division:** Division includes all organisms belonging to different classes having a few common characters.
- **Kingdom:** It is largest taxonomic category based only on few general characters

There are **7 main** taxonomic categories. They are **obligate or essential or broad categories** i.e. they are strictly used at the time of any plant classification. There are some extra or sub categories, like sub division, sub order, sub family, etc. They are used only when they are needed

Note: Tribe is present in between sub-family and genus



- The classification of any plant or animal is written in **descending** or **ascending** order.
- **Taxonomic Hierarchy** - **Descending** or ascending arrangement of taxonomic categories is known as hierarchy.

Suffix taxa (Taxon)	
Division	_phyta
Class	_opsida, phyceae, ae
Order	_ales
Family	_aceae

Organisms with their Taxonomic Categories

Common Name	Biological Name	Genus	Family	Order	Class	Phylum/ Division
Man	*Homo sapiens*	*Homo*	Hominidae	Primata	Mammalia	Chordata
Housefly	*Musca domestica*	*Musca*	Muscidae	Diptera	Insecta	Arthropoda
Mango	*Mangifera indica*	*Mangifera*	Anacardiaceae	Sapindales	Dicotyledonae	Anglospermae
Wheat	*Triticum aestivum*	*Triticum*	Poaceae	Poales	Monocotyledonae	Angiospermae

Note:

- As we go higher from species to kingdom number of common characters decreases. Lower the taxa more are the characteristics that the members with in the taxon share.
- Higher the category, greater is the difficulty of determining the relationship to other taxa at the same level.

Concept Builder

1. Which of the followings have maximum common characters?
(1) Felidae, Canidae (2) Potato, Brinjal (3) Carnivora, Primata (4) *Datura*, *Petunia*

2. Which of the following statement is **correct**?
(1) Potato and brinjal are two different genera
(2) Lion and tiger are placed in different genera
(3) *Petunia* and *Datura* are placed in same family
(4) Solanaceae and Poaceae are placed in same class.

3. The process of classification of all living organism into different taxa based on their characteristics is referred as:
(1) Taxonomy (2) Systematics (3) Nomenclature (4) Identification

4. Select the **Correct** option w.r.t. hierarchical arrangement of taxonomic categories in ascending order.
(1) Division → Class → Order → Family (2) Genus → Family → Order → Class
(3) Species → Order → Class → Family (4) Kingdom → Order → Family → Genus

5. Taxonomic category with a group of related genera is characterized on the basis of:

(1) Cell structure (2) Vegetative features

(3) Only floral characters (4) Vegetative and reproductive features

6. In ascending order of taxon common morphological characters are:

(1) Decrease (2) Increase

(3) First decrease than increase (4) First increase than decrease

Concept Builder (Answer-Key)						
Que.	**1**	**2**	**3**	**4**	**5**	**6**
Ans.	2	3	1	2	4	1

Species Concept

- **John Ray:** Proposed the **term** and **concept of species.**

Biological Concept of Species:

(1) **Ernst Mayr** (Darwin of 20th century) proposed the **Biological Concept of Species.**

(2) According to Mayr "Species is the group of individual which can interbreed naturally and produce fertile offspring. This definition of Mayr was incomplete because this definition is applicable to only on sexually reproducing living beings but there are many organisms that have only asexual mode of reproduction. eg. Bacteria, Mycoplasma. BGA

(3) Biological species concept is based on **reproductive isolation.**
In taxonomy, the determination of species is mainly based on morphological characters

Taxonomical Aids

Biologists have established certain procedures and techniques to store and preserve the information as well as the specimens. These are known as taxonomic aids.

1. Herbarium:

- Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheet. Standard size of herbarium sheet is **11.5 x16.5** inches.
- These sheets are arranged according to a universally accepted system of classification.
- The herbarium sheets also carry a label providing information about date and place of collection, English, local and botanical names, family, collector's name, etc.
- These specimens, along with their descriptions on herbarium sheets, become a store house or repository for future use.
- Herbaria also serve as quick referral systems in taxonomical studies.

2. Botanical Gardens:

- These specialised gardens have collections of living plants for reference. Plant species in these gardens are grown for identification purposes and each plant is labelled indicating its botanical/scientific name and its family.
- The famous botanical gardens are.
- **Royal Botanical Garden Kew (England).**
- **Indian Botanical Garden, Howrah. (India)**
- **National Botanical Research Institute. Lucknow (India).**

3. **Museums:**
    - Museum have concerns of preserved plant and animal specimens for study and reference.
    - Specimens are preserved in the containers or jars in preservative solutions.
    - Plant and animal specimens may also be preserved as dry specimens.
    - Insects are preserved in insect boxes after collecting, killing and pinning.
    - Larger animals like birds and mammals are usually stuffed and preserved.
    - Museums often have collections of skeletons of animals too.

4. **Zoological Parks:**
    - These are the places where wild animals are kept in protected environments under human care and which enable us to learn about their food habits and behavior.
    - All animals in a zoo are provided, as far as possible the conditions similar to their natural habitats.

5. **Key:**
    - Key is used for identification of plants and animals based on the similarities and dissimilarities
    - The keys are based on the contrasting characters generally in a pair called **couplet**. It represents the choice made between the two opposite options. This result in acceptance of only one and rejection of the other.
    - Each statement of couplet in the key is called a **lead**.
    - Separate taxonomic keys are required for each taxonomic category such as family, genus and species

      for identification purpose.
    - Keys are generally **analytical** in nature.
    - Indented (Yoked) key & bracketed key are two types of taxonomic Key. Bracketed key is the most popular & commonly preferred.

6. **Catalogue:**
    - It is small booklet which gives an account of the special books of botanical titles, full name of authors and their publication.

7. **Flora:**
    - It contains the actual account of habitat and distribution of plants of a given area. These also provide the index to the plant species found in the particular area.

8. **Manuals:**
    - They are useful in providing information for identification of names of species found in an area.

9. **Monographs:**
    - They contain information on any one taxon.

Concept Builder

1. Taxonomic categories are __A__ biological entities & __B__ morphological aggregates. A & B respectively stand for:

(1) Same, Merely (2) Distinct, Not merely

(3) Same, Not merely (4) Distinct, Merely

2. Quick referral system in taxonomy is?

(1) Herbarium (2) Monograph (3) Manual (4) Botanical garden

3. Special garden showing collection of living plants is:

(1) Zoos (2) Zoological park (3) Botanical Garden (4) Museum

4. "Wild Animals are conserved under human survillence" in.

(1) Zoological park (2) Museum (3) Botanical Garden (4) Key

5. Most important taxonomical tool for identification of organism in taxonomy is:

(1) Manual (2) Key (3) Monograph (4) Flora

6. Where does the botanical name of plants label?

(1) Sanctuary (2) National part

(3) Botanical Garden (4) All above

7. Which of the following represents choice made between two opposite options?

(1) Lead (2) Couplet (3) Flora (4) Both (1) & (2)

8. Skeleton of animals are collected in:

(1) Museum (2) Zoological park

(3) Botanical Garden (4) Key

9. If we used to know name of species in a particular area. Which of the following taxonomical aid is helpful?

(1) Flora (2) Manuals (3) Key (4) Monograph

10. "Study of any one taxon" refers to:

(1) Museum (2) Manual (3) Monograph (4) Key

Concept Builder (Answer-Key)										
Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.	2	1	3	1	2	3	2	1	2	3

Exercise - I

1. Mayr proposed which type of concept of species:
(1) Static concept
(2) Biological concept
(3) Topological concept
(4) Genetic concept

2. Artificial system of classification classifies plants on the basis of:
(1) One or two characters
(2) Phylogenetic trends
(3) Many naturally existing characters
(4) None of the above

3. Group of organisms that closely resemble each other and freely interbreed in nature, constitute a:
(1) Species (2) Genus
(3) Family (4) Taxon

4. ICBN was first published in:
(1) 1961 (2) 1964
(3) 1975 (4) 1753

5. The term taxon refers to:
(1) Name of a species
(2) Name of genus
(3) Name of family
(4) A taxonomic group of any rank

6. The basic smallest unit of classifications is:
(1) Genus (2) Species
(3) Order (4) All of the above

7. Plant nomenclature means:
(1) To give names to plants without any rules
(2) Nomenclature of plants under the international rules
(3) Nomenclature of plants in local language
(4) Nomenclature of plants in English language

8. Taxonomy refers to:
(1) Plant classification
(2) Plant nomenclature
(3) Plant affinity
(4) All the above

9. Which of the following is a correct name?
(1) *Solanum tuberosum*
(2) *Solanum Tuberosum*
(3) *Solanum tuberosum* Linn.
(4) All the above

10. Systematics deals with:
(1) Classification
(2) Nomenclature
(3) Plant description
(4) Identification

11. Phylogeny refers to:
(1) Natural classification
(2) Evolutionary classification
(3) Evolutionary history
(4) Origin of algae

12. Who wrote 'Systema Naturae'?
(1) Linnaeus (2) Mayr
(3) John Ray (4) De Candolle

13. For higher plants, flowers are chiefly used as a basis of classification, because:
(1) These show a great variety in colour
(2) It can be preserved easily
(3) Reproductive parts are more conservative than vegetative parts
(4) None of these

14. Who is regarded as "Darwin of 20th century" ?
(1) John Ray (2) Lamarck
(3) Ernst Mayr (4) Darwin

15. A division is formed by combining several:
(1) Orders (2) Families
(3) Classes (4) Tribes

16. For declaration of new species of higher plants what characters are used:
(1) Floral character of new species
(2) Anatomical characters of new species
(3) Physiological character of new species
(4) Character of endosperm

17. The standared size of herbarium sheets is:
(1) 11.5" × 16.5" (2) 15.5" × 16.5"
(3) 18.5" × 10.5" (4) 20.5" × 21.5"

18. Which of the following statements regarding the response of living organisms to external stimuli is correct?
(1) The external environmental stimuli can be physical, chemical or biological
(2) All organisms, from the prokaryotes to the most complex eukaryotes can sense and respond to environmental stimuli.
(3) Consciousness and response to external stimuli is the defining property of living organisms.
(4) All of these

19. Most of the botanical names are drawn from the following language:
(1) German (2) Greek
(3) Latin (4) Spanish

20. Which of the following statements regarding nomenclature is correct?
(1) Generic name always begins with capital letter whereas specific name with small letter
(2) Scientific name should be printed in italics
(3) Scientific name when typed or handwritten should be underlined
(4) All the above

21. Which of the following is correct?
(1) Properties of tissues are not present in the constituent cells but arise as a result of interactions among the constituent cells
(2) Properties of cellular organelles are not present in the molecular constituents of the organelle but arise as a result of interactions among the molecular components comprising the organelle
(3) Both (1) and (2)
(4) Consciousness is the defining property of only few organisms

22. Animals, mammals and dogs represent:
(1) Taxa at different levels
(2) Taxa at same level
(3) Different levels of same taxa
(4) All are correct

23. Read the following statements:
(i) Classification is a single step process
(ii) Classification involves hierarchy of steps in which each step represents a rank or category
(iii) Taxon is a unit of ecological hierarchy
(iv) Insects represents a species
(v) The taxonomic group/categories are distinct biological entities and not merely morphological aggregates
How many of the above statements are correct?
(1) Five (2) Three
(3) Two (4) One

24. As we go from species to kingdom in a taxonomic hierarchy, the number of common characteristics:
(1) Will decrease
(2) Will increase
(3) Remain same
(4) May increase or decrease

25. Which of the following is a defining characteristic of living organisms?
(1) Growth
(2) Ability of make sound
(3) Reproduction
(4) Response to external stimuli

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	2	1	1	1	4	2	2	4	3	3	3	1	3	3	3	1	1	4	3	4	3	1	3	1	4

Exercise – II

1. The number and types of organisms present on earth make:
(1) Taxonomy (2) Plant diversity
(3) Animal diversity (4) Biodiversity

2. The process by which anything is grouped into convenient categories based on some easily observable characters is called as:
(1) Biodiversity (2) Classifications
(3) Identification (4) Nomenclature

3. The process in which biologists follow universally accepted principles to provide name of any organism is called as:
(1) Identification (2) Classification
(3) Nomenclature (4) Systematics

4. What are the essential basis of modern taxonomic studies?
(1) External and internal structure
(2) Structure of cell
(3) Developmental process and ecological information
(4) All of these

5. In the names *Mangifera indica*, *Solanum tuberosum* and *Panthera leo*, the words indica, tuberosum and leo represent:
(1) Generic name (2) Generic epithet
(3) Specific name (4) Specific epithet

6. Why the determination of relationship becomes more complex in higher taxonomic categories?
(1) Number of common characters goes on decreasing in lower taxa
(2) Number of common characters goes on decreasing in higher taxa
(3) Because classification itself is very difficult process
(4) Number of common characters goes on increasing in higher taxa

7. Which of the following is not a correct statement?
(1) Order is the assemblage of families which exhibit a few similar characters in comparisation to families
(2) Convolvulaceae and Solanaceae families are included in order polymoniales mainly on the basis of floral characters
(3) In hierarchy both broad categories and sub categories are used
(4) Class is a sub category which includes related order

8. Which of the following is not used as taxonomic aid?
(1) Zoological park (2) Soil
(3) Herbarium (4) Museum

9. In which group of taxonomic aids only the means of recording descriptions are included:
(1) Botanical gardens, Museum, Keys
(2) Botanical Gardens, Museum, Keys
(3) Flora, manual, Monograph
(4) Botanical Garden, Museum, Monographs

10. Taxonomists use to prepare and disseminate taxonomic informations:
(1) Manuals and monographs
(2) Museum and herbarium
(3) Zoological park and herbarium
(4) Keys and herbarium

11. Which of the following taxonomic aid is useful only in case of animals?
(1) Botanical gardens
(2) Museum
(3) Keys
(4) Zoological parks

12. All the categories used in classification of organism constitute:
(1) Taxonomy
(2) Systematics
(3) Taxonomic hierarchy
(4) Taxonomic affinity

13. Read the following statements:
(i) Yeast and Hydra can reproduce asexually by budding
(ii) Fungi multiply and spread easily due to the millions of asexual spores they produce
(iii) In *Planaria* we observe true regeneration
(iv) Fungi, the filamentous algae, the protonema of mosses, all easily multiply by fragmentation
(v) In unicellular organism reproduction and growth are exclusive events and not inclusive.
How many of the above statements are **correct**?
(1) Four (2) Two (3) Three (4) One

14. Live specimens of plants & animals are respectively found in:
(1) Botanical Garden & Zoological Park
(2) Zoological Park & Botanical Garden
(3) Herbarium & Museum
(4) Botanical Garden & Herbarium

15. Read the following statements:
(i) Separate taxonomic keys are required for each taxonomic category such as family, genus and species
(ii) Keys are fully theoretical and not analytical at all
(iii) Each statement in the key is called lead
(iv) Key is used for the identification of plants but not animals
(v) Key are generally analytical in nature
How many of the above statements are correct?
(1) Three (2) Two (3) Four (4) Five

16. Match the column:

Column-I		Column-II	
A.	Llyod Botanical Garden	(i)	England
B.	National Botanical Research Institute	(ii)	Howrah
C.	Indian Botanical Garden	(iii)	Darjeeling
D.	Royal Botanical Garden	(iv)	Lucknow

(1) A = (iii), B= (iv), C = (ii), D = (i)
(2) A = (i), B= (ii), C = (iii), D = (iv)
(3) A = (iv), B= (iii), C = (ii), D = (i)
(4) A = (i), B= (iv), C = (iii), D = (ii)

17. Which arrangement is in correct ascending order?
(1) Species < genus < order < family
(2) Genus < species < family < order
(3) Order < family < Genus < species
(4) Species < genus < family < order

18. Sequence of which of the following is used to know the phylogeny:
(1) m-RNA (2) r - RNA
(3) t - RNA (4) DNA

19. Species are considered as:
(1) Real basic units of classification
(2) The lowest units of classification
(3) Artificial concept of human mind
(4) Biggest units of classification devised by taxonomists

20. Which of the following is **not true** for a species?
(1) Variations occur among members of a species
(2) Gene flow does not occur between the populations of a species
(3) Each species is reproductively isolated from every other species
(4) Members of a species can interbreed

21. Study the following statements carefully and give the answer:

A. Biological names are generally in Latin and printed in italics.

B. The first word in biological names represents the genus.

C. Both the words in a biological name are separately underlined when printed.

D. The first word of biological name starts with capital letter when given in memory of a person otherwise with small letter.

(1) A, D - correct B, C - correct

(2) A, C - correct B, D - incorrect

(3) A, B - correct C, D - incorrect

(4) A, B - incorrect C, D - correct

22. How many are the **incorrect** statements from the followings?

(A) In museum insects are preserved in insect boxes after collecting and killing.

(B) Monkey, gorilla and gibbon are placed in class mammalia.

(C) In an order similar characters are more as compared to different genera induced in a family.

(D) Three pairs of jointed legs are present in all chordates.

(1) Two (2) Three

(3) One (4) Four

23. Which of the following is / are **not correctly** match?

	Common Name	**Genus**	**Family**
(i)	Man	Homo	Hominidae
(ii)	Housefly	Musa	Muscidae
(iii)	Mango	Mangifera	Anacardiaceae
(iv)	Wheat	Triticum	Poaceae

(1) i & ii (2) only i

(3) only ii (4) iii & iv

24. How many are the **incorrect** statements from the followings?

(A) Lower the taxa, more are the characteristics that the members within the taxon share

(B) Higher the taxonomic category, greater is the difficulty of determining the relationships to other taxa at the same level

(C) In lower taxa the problems of classification becomes more complex

(D) As we go higher from species to kingdom, the number of common characters increases

(1) One (2) Two

(3) Three (4) Four

25. Some taxonomical aids are given in the following options; which option is correct to be used as quick referral system?

(1) Herbarium and books

(2) Botanical garden and Zoological park

(3) Zoological park and Herbarium

(4) Biological museum and Zoological park

26. Nomenclature is very must in taxonomy which of the following is **not correct** about scientific nomenclature?

(1) They ensure that each organism has only one name

(2) They also ensure that such a name has not been used for any other known organism

(3) Scientific nomenclature is a standardised naming system

(4) Different countries of the world use different kinds of scientific nomenclature system

27. The relation of solanaceae and convolvulaceae with polymoniales is similar to the relation occuring in:

(1) Felidae and canidae with carnivora

(2) Primata and carnivora with mammalia

(3) Amphibia and reptilia with chordata

(4) *Solanum* and *Petunia* with solanaceae

28. In potato, brinjal, lion, leopard, and tiger. how many species and genera are there respectively?

(1) 4 & 2 (2) 5 & 3

(3) 5 & 4 (4) 5 & 2

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	4	2	3	4	4	2	4	2	3	1	4	3	1	1	1	1	4	2	1	2	3	1	3	2	1
Que.	26	27	28																						
Ans.	4	1	4																						

Exercise – III (Previous Year Question)

[AIPMT-2006]

1. Evolutionary history of an organism is known as:

(1) Paleontology (2) Ontogeny
(3) Phylogeny (4) Ancestry

[AIPMT-2007]

2. Two plants can be conclusively said to belong to the same species if they:

(1) Have same number of chromosomes
(2) Can reproduce freely with each other and form seeds
(3) Have more than 90 percent similar genes
(4) Look similar and possess identical secondary metabolites.

3. ICBN stands for:

(1) Indian Code of Botanical Nomenclature
(2) Indian Congress of Biological Names
(3) International Code of Botanical Nomenclature
(4) International Congress of Biological Names

[NEET-UG-2013]

4. Which one of the following is **not** a correct statement?

(1) Key is taxonomic aid for identification of specimens
(2) Herbarium houses dried, pressed and preserved plants specimen
(3) Botanical gardens have collection of living plant for reference
(4) A museum has collection of photographs of plants and animals

5. *Planaria* possess high capacity of:

(1) Metamorphosis
(2) Regeneration
(3) Alternation of generation
(4) Bioluminescence

[NEET-I-2016]

6. Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature?

(1) Biological names can be written in any language
(2) The first word in a biological name represents the genus name and second is specific epithet
(3) The names are written in latin and are italicized
(4) When written by hand, the names are to be underlined

7. The label of a herbarium sheet does not carry information on:

(1) Name of collector
(2) Local names
(3) Height of the plant
(4) Date of collection

8. Match Column I with Column II for housefly classification and select the correct option using the codes given below:

Column-I	**Column-II**
(a) Family	(i) Dipetera
(b) Order	(ii) Arthropoda
(c) Class	(iii) Muscidae
(d) Phylum	(iv) Insecta

Codes:

	(a)	**(b)**	**(c)**	**(d)**
(1)	(iii)	(ii)	(iv)	(i)
(2)	(iv)	(iii)	(ii)	(i)
(3)	(iv)	(ii)	(i)	(iii)
(4)	(iii)	(i)	(iv)	(ii)

9. Study the four statements (A-D) given below and select the two correct ones out of them:

(A) Definition of biological species was given by Ernst Mayr

(B) Photoperiod does not affect reproduction in plant

(C) Binomial nomenclature system was given by R. H. Whittaker

(D) In unicellular organisms, reproduction is synonymous with growth

The two correct statement are:

(1) C and D (2) A and D

(3) A and B (4) B and C

[NEET–2018]

10. Match the items given in Column-I with those Column-II and select the ***Correct*** option given below:

	Column-I		Column-II
(a)	Herbarium	(i)	It is a place having a collection of preserved plants and animals.
(b)	Key	(ii)	A list that enumerates methodically all the species found in an area with brief description aiding identification.
(c)	Museum	(iii)	Is a place where dried and pressed plant specimens mounted on sheets are kept.
(d)	Catalogue	(iv)	A booklet containing a list of characters and their alternates which are helpful in identification various taxa.

	a	b	c	d
(1)	i	iv	iii	ii
(2)	iii	ii	i	iv
(3)	ii	iv	iii	i
(4)	iii	iv	i	ii

[NEET–2019]

11. Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus:

(1) *Mangifera indica*

(2) *Mangifera Indica*

(3) *Mangifera indica Car. Linn.*

(4) *Mangifera indica Linn.*

12. Which of the following statements is I incorrect?

(1) Infective constituent in viruses is the protein coat.

(2) Prions consist of abnormally folded proteins.

(3) Viroids lack a protein coat.

(4) Viruses are obligate parasites.

[NEET–2020]

13. Which of the following is against the rules of ICBN?

(1) Hand written scientific names should be underlined.

(2) Every species should have a generic name and a specific epithet.

(3) Scientific names are in Latin and should be italicized.

(4) Generic and specific names should be written starting with small letters.

14. The contrasting characteristics generally in a pair used for identification of animals in taxonomic key are referred to as:

(1) Lead (2) Couplet

(3) Doublet (4) Alternate

15. Which one of the following belongs to the family muscidae?

(1) Fire fly (2) Grasshopper

(3) Cockroach (4) House fly

[NEET–2022]

16. In the taxonomic categories which hierarchical arrangement in ascending order is correct in case of animals?

(1) Kingdom, Phylum, Class, Order, Family, Genus, Species

(2) Kingdom, Class, Phylum, Family, Order, Genus, Species

(3) Kingdom, Order, Class, Phylum, Family, Genus, Species

(4) Kingdom, Order, Phylum, Class, Family, Genus, Species

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ans.	3	2	3	4	2	1	3	4	2	4	4	1	4	2	4	1