

LIVING WORLD

(NV)

Life can be defined as unique complex organization of molecules expressing itself through chemical reactions which lead to growth, development, responsiveness, adaptation and reproduction

- Viruses are nonliving lifeless particle outside the living organism but become active inside cells of living beings

Characteristics of living beings

1. Growth

- Increase in **mass** and increase in **number of individuals** are **twin** characteristics of growth.
- In plants, this growth by cell division occurs continuously throughout their life span.
- In animals, this growth is seen only up to a certain age. However, cell division occurs in certain tissues **to replace lost cells**.
- Unicellular organisms also grow by cell division (increase in number).
- Increase in body mass is considered as growth.
- Non-living objects also grow if we take increase in body mass as a criterion for growth. Mountains, boulders and sand mounds do grow. Growth, therefore, cannot be taken as a defining property of living organisms.
- A dead organism does not grow.

2. Reproduction

- In multicellular organisms, reproduction refers to the production of progeny possessing features more or less similar to those of parents. we refer it as sexual reproduction.
- Fungi multiply and spread easily due to the millions of **asexual spores** they produce.
- In lower organisms like **yeast and hydra**, we observe **budding**.
- In Planaria (flat worms), we observe true **regeneration**, i.e., a fragmented organism regenerates the lost part of its body and becomes, a new organism.
- **The fungi**, the filamentous algae, the protonema of mosses, all easily multiply by **fragmentation**.

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- **in unicellular** organisms like bacteria, unicellular algae or Amoeba, reproduction is synonymous with growth, i.e., increase in number of cells
- There are many organisms which do not reproduce (mules, sterile worker bees, infertile human couples, etc). Hence, reproduction also cannot be an all-inclusive defining characteristic of living organisms.
- No non-living object is capable of reproducing or replicating by itself

3. Metabolism

- The sum total of all the chemical reactions occurring in our body is metabolism No non-living object exhibits metabolism
- Metabolisms is a defining feature of all living organism **without exception**

4. Cellular organization

- All organisms consist of one or more cells.
- Cells-tissues-organs-organ system-organism

5. consciousness

- All organism from prokaryote to eukaryotes can sense and respond to environmental cues. Human being is the only organism who is aware of himself ie: Consciousness
- All organisms therefore, are 'aware' of their surroundings.

DIVERSITY IN THE LIVING WORLD

- The number and types of organisms present on earth is called Biodiversity
- The number of species that are known and described range between **1.7-1.8 million**.

TAXONOMY

- **characterisation, identification, classification and nomenclature** are the processes that are basic to taxonomy

1. Characterization: It is the understanding of characters of organisms such as external and internal structure, structure of cell, development process, ecological information etc.

2. Identification: Nomenclature is only possible when the organism is described correctly and we know to what organism the name is attached to. This is called identification.

3. Classification: It is the grouping of organisms into convenient categories (taxa) based on characters.

Universal rules of nomenclature

1. Biological names are generally in **Latin** and written in **italics**. They are Latinised or derived from Latin irrespective of their origin.
2. The **first word** in a biological name represents the **genus** while the **second** component denotes the **specific epithet**.
3. Both the words in a biological name, when handwritten, are separately **underlined**, or **printed in italics** to indicate their Latin origin.
4. The first word denoting the genus starts with a **capital letter** while the specific epithet starts with a small letter. It can be illustrated with the example of *Mangifera indica*.

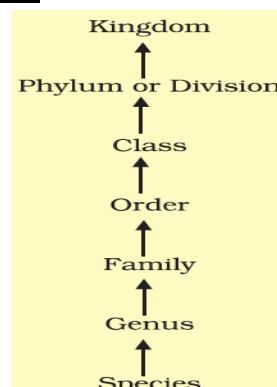
- **Name of the author** appears after the specific epithet, i.e., at the end of the biological name and is written in an abbreviated form, e.g., *Mangifera indica* **Linn**. It indicates that this species was first described by **Linnaeus**

SYSTEMATICS

- The study of different kinds of organisms and their diversities, and also the relationships among them is called systematics.
- The word systematics is derived from the **Latin** word '**systema**' which means **systematic arrangement of organisms**.
- **Linnaeus** used **Systema Naturae** as the title of his publication.

TAXONOMIC CATEGORIES

Taxonomical studies of all known organisms have led to the development of common categories such as **kingdom, phylum or division (for plants), class, order, family, genus and species**. All organisms, including those in the plant and animal kingdoms have **species as the lowest category**



- Based on characteristics, all living organisms can be classified into **different taxa**. This process of classification is taxonomy

• Q) Why living organisms classified ?

Ans : it is nearly impossible to study all the living organisms, it is necessary to devise some means to make this possible. This process is classification. Classification is the process by which anything is grouped into convenient categories based on some easily observable characters. The scientific term for these categories is **taxa** based on characteristics, all living organisms can be classified into different taxa. This process of classification is taxonomy

4. Nomenclature (naming): It is the providing of standardized names to the organisms such that a particular organism is known by the same name all over the world.

Q) Why the names of living organism should be standardized ?

- **Ans :There** are millions of plants and animals in the world; we know the plants and animals in our own area by their local names. These local names would vary from place to place, even within a country, hence, there is a **need to standardise** the naming of living organisms such that a particular organism is known by the same name all over the world. This process is called **nomenclature**. The scientific names ensure that each organism has only one name.
- For plants, scientific names are based on agreed principles and criteria, which are provided in **International Code for Botanical Nomenclature (ICBN)**.
- Animal taxonomists have evolved **International Code of Zoological Nomenclature (ICZN)**.

Binomial Nomenclature

- Biologists follow universally accepted principles to provide scientific names to known organisms. Each name has two components – the **Generic name and the specific epithet**.
- This system of providing a name with two components is called **Binomial nomenclature**. This naming system given by **Carolus Linnaeus**



Species

It is the **lowest or basic unit** in taxonomic hierarchy. Species are group of **closely related organism which are genetically distinct and are capable of interbreeding to produce fertile offspring**. This definition is given by **Ernst Mayr (Darwin of 20th century)**

Eg: *Mangifera indica*, *Solanum tuberosum* (potato) and *Panthera leo* (lion). All the three names, indica, tuberosum and leo, represent the specific epithets

- Each genus may have one or more than one specific epithets representing different organisms, but having morphological similarities

For example: *Panthera* has another specific epithet called tigris and *Solanum* includes species like nigrum and melongena

Genus

It is a group of related species, which resemble one another.

For example: 1. potato, tomato and brinjal are three different species but all belong to the genus *Solanum*.

2. Lion (*Panthera leo*), leopard (*P. pardus*) and tiger (*P. tigris*) with several common features, are all species of the genus *Panthera*. This genus differs from another genus **Felis** which includes cats

Family

Similar genera are grouped under family.

for example 1., three different genera *Solanum*, *Petunia* and *Datura* are placed in the family **Solanaceae**.

2. genus *Panthera*, comprising lion, tiger, leopard is put along with genus, *Felis* (cats) in the family **Felidae**

3. dog coming under family **canidae**

Order

It is a group of related families resembling one another in a few characters

Eg1.. Plant families like **Convolvulaceae**, **Solanaceae** are included in the order **Polymoniales** mainly based on the floral characters.

2. The animal **order, Carnivora**, includes families like **Felidae and Canidae**

Class

It is a group of related orders having some common characters.

For example, order Primata comprising monkey, gorilla and gibbon is placed in class Mammalia along with order Carnivora that includes animals like tiger, cat and dog. Class Mammalia has other orders also

Phylum

It is group of related class having some common features.

In case of **plants**, classes with a few similar characters are assigned to a higher category called **Division**

Kingdom

All animals belonging to various phyla are assigned to the highest category called **Kingdom Animalia** in the classification system of animals.

All Plants belonging to **various divisions** are assigned to the highest category called **Kingdom Plantae**

- in the classification system of plants as we go higher from species to kingdom, the number of **common characteristics goes on decreasing**.
- Lower the taxa, more are the characteristics that the members** within the taxon share.
- Higher the category, greater is the difficulty of determining the relationship to other taxa at the same level.

Organisms with their Taxonomic Categories

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

Taxonomical Aids

Identification of organisms requires intensive laboratory and field studies. The collection of actual specimens of plant and animal species is essential and is the prime source of taxonomic studies.

Biologists have established certain procedures and techniques to store and preserve the information as well as the specimens. Some of them are given below

1. Herbarium

Herbarium is a **store house** of collected plant specimens that are dried, pressed and preserved on sheets. Further, these sheets are arranged according to a universally accepted system of classification.

These specimens, along with their descriptions on herbarium sheets, become a store house or repository for future use.

- 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. Herbaria also serve as quick referral systems in taxonomical studies.

2. Botanical Garden

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 (Royal botanical garden) are at Kew (England),
- Indian Botanical Garden, Howrah (India) and at National Botanical Research Institute, Lucknow (India).

3. Museum

Museums have collections 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 Park

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 behaviour**.

- All animals in a zoo are provided, as far as possible, the conditions similar to their natural habitats

5. Key

- Key is another taxonomical aid used for identification of plants and animals based on the **similarities and dissimilarities**.
- Each statement in the key is called a lead. The keys are based on the contrasting characters generally in a pair called **couplet**. It represents the choice made between two opposite options. This results in acceptance of only one and rejection of the other
- Separate taxonomic keys are required for each taxonomic category such as family, genus and species for identification purposes.
- Keys are generally analytical in nature.
- Flora, manuals, monographs and catalogues are some other means of recording descriptions. They also help in correct identification.

Flora

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

Manuals

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

Monographs

It contains information on **any one taxon**.

Previous years Questions

1. Rearrange the following taxonomic categories in the correct sequence. (HSE-March-2018)(1)

Kingdom ← Class ← Phylum ← Genus ← Family ← Order ← Species

2. ICZN stands for (HSE-model-2018)(1)

- a) International Council of Zoological Nomenclature
- b) Indian Council of Zoological Nomenclature
- c) International Code of Zoological Nomenclature
- d) Indian Code of Zoological Nomenclature

3. Find out the odd one on the basis of taxonomy and justify your answer (HSE-July-2017)(1)

- a) Family
- b) Order
- c) Class
- d) Herbarium
- e) Phylum

4. Select the correct sequence of taxonomic hierarchy. (HSE-March-2017)(1)

- a) Kingdom-Phylum-class-order-genus-family-species
- b) Kingdom-phylum,order-class-family-genus-species
- c) Kingdom-Phylum-class order-Family-Genus-Species
- d) Kingdom-Class-Phylum-Family-Order-Species-Genus

5. Observe the first pair of words and write a suitable word for the second pair

Botanical garden : Living plants

.....: Living animals

(HSE Sept-2016)(1)

6. During adventure trip a plus one student got a skull and skeletal part of rare animal from the Chinnar forest. Select suitable location for keeping it from the list taxonomical aids given below (HSE March-2016)(1)

(Herbarium, museum, zoological park, Botanical garden)

7. A student conceived the rules of nomenclature as follows. If you find any

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mistake in the underlined portions, correct them with appropriate words

(HSE September-2015) (1)

- a. The first word in a biological name represent species and begins with a Capital letter
- b. The second word represents Genus and begins with a small letter

8. Complete the tale using suitable terms

(HSE MARCH-2015) (1)

Common name	Genus	Species	Class	Phylum
Man		Sapiens	Mammalia	

9. Select the correct Generic name and specific epithet from the table given below and write the scientific name of House fly

(HSE AUGUST-2014) (1)

Generic name	Specific epithet
<i>Mangifera</i>	<i>domestica</i>
<i>Musca</i>	<i>indica</i>

10. Align the taxonomical categories in the ascending order. (HSE MARCH-2014)(1)

(Genus, order, phylum, species, family, class, kingdom)

11. Rearrange both the biological category and taxon based on taxonomical hierarchy

(HSE OCTOBER-2013) (1)

(Hint-The last two terms of taxon will give the scientific name of house fly)

Category	Taxon
Phylum	Musca
Genus	Insecta
Class	Arthropoda
Species	Domestica

12. After completing a project study based on diversity of spiders, the specimens were intended to be stored for future reference. Select a suitable taxonomical aid from the following for the preservation of specimens.(1) (HSE MARCH-2013)

- a) Herbarium b) Museum
- c) Zoological park d) Sanctuary

Justify your answer



13. Categorize the following terms into two. Give suitable title for each category.

(HSE-SEPTEMBER-2012)(1)

Species, museum, class, genus,
zoological park, herbarium

14. Taxonomical aids are very useful for classification and identification of organisms.

Name any two taxonomical aid

(HSE MARCH-2012)(1)

15. Note the relationship between the first two words and suggest suitable word for the fourth place (HSE MARCH-2011) ($2 \times \frac{1}{2} = 1$)

a. Collection of living plants : botanical garden, animals kept in protected environment:

b. *Homo sapiens* :Man,
Musca domestica :.....

16. Rearrange the following in correct taxonomic hierarchical sequence (HSE MARCH-2010) (1)

Sapiens->Hominidae->Homo->Mammalia->Primata->Chordata

17. Raju collected a skull of animal and a living rare animal during a study tour. Select the suitable location for each from the list given in the brackets (HSE MARCH-2009)(1)

(Botanical garden, Zoological park, Herbarium, Museum)

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