

# DIVERSITY OF LIFE: CHAPTER-1: THE LIVING WORLD

## CHAPTER-1:

### THE LIVING WORLD

- ➔ What is living?
- ➔ Biodiversity; Need for classification; three domains of life;
- ➔ taxonomy and systematics; concept of species and taxonomical hierarchy;
- ➔ binomial nomenclature; tools for study of taxonomy-museums,
- ➔ zoological parks, herbaria,
- ➔ botanical gardens.

#### INTRODUCTION

##### 1.1 LIVING ORGANISM

All living organisms grow. Increase in mass and increase in number of individuals are twin characteristics of growth. A multicellular organism grows by cell division. 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.

Unicellular organisms grow by cell division. One can easily observe this in in vitro cultures by simply counting the number of cells under the microscope

Non-living objects also grow if we take increase in body mass as a criterion for growth. Mountains, boulders and sand

mounds do grow. However, this kind of growth exhibited by non-living objects is by accumulation of material on the surface. In living organisms, growth is from inside. Growth, therefore, cannot be taken as a defining property of living organisms.

*Escherichia coli* is a microscopic single-celled organism, and a prokaryote as well.

Amoebae are single-celled eukaryotes

Polypore fungi and angiosperm trees are large many-celled eukaryotes.

In biology, an organism (from Greek: ὁργανισμός, organismos) is any individual entity that exhibits the properties of life. It is a synonym for "life form".

Estimates on the number of Earth's current species range from 10 million to

14 million, of which only about 1.2 million have been documented.

More than 99% of all species, amounting to over five billion species, that ever lived are estimated to be extinct.

In 2016, a set of 355 genes from the last universal common ancestor (LUCA) of all organisms was identified

## 1.2 FEATURES OF LIVING ORGANISM : REPRODUCTION

In multicellular organisms, reproduction refers to the production of progeny possessing features more or less similar to those of parents.

Organisms reproduce by asexual means also. 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. When it comes to unicellular organisms like bacteria, unicellular algae or Amoeba, reproduction is synonymous with growth, i.e., increase in number of cells.

Reproduction also cannot be an all-inclusive defining characteristic of living organisms. Of course, no non-living

object is capable of reproducing or replicating by itself.

**METABOLISM.** All living organisms are made of chemicals. These chemicals, small and big, belonging to various classes, sizes, functions, etc., are constantly being made and changed into some other biomolecules. These conversions are chemical reactions or metabolic reactions. There are thousands of metabolic reactions occurring simultaneously inside all living organism

unicellular or multicellular. All plants, animals, fungi and microbes exhibit metabolism. The sum total of all the chemical reactions occurring in our body is metabolism. No non-living object exhibits metabolism.

Metabolic reactions can be demonstrated outside the body in cell-free systems.

An isolated metabolic reaction(s) outside the body of an organism, performed in a test tube is neither living nor non-living. Hence, while metabolism is a defining feature of all living organisms without exception, isolated metabolic reactions in vitro are not living things but surely living reactions.

living organisms is this ability to sense their surroundings or environment and respond to these environmental stimuli which could be physical, chemical or biological. We sense our environment

through our sense organs. Plants respond to external factors like light, water, temperature, other organisms, pollutants, etc.

All organisms, from the prokaryotes to the most complex eukaryotes can sense and respond to environmental cues. Photoperiod affects reproduction in seasonal breeders, both plants and animals.

All organisms handle chemicals entering their bodies.

All organisms therefore, are 'aware' of their surroundings.

Human being is the only organism who is aware of himself, i.e., has self-consciousness. Consciousness therefore, becomes the defining property of living organisms.

*Hence, cellular organisation of the body is the defining feature of life forms*



Escherichia coli is a microscopic single-celled organism, and a prokaryote as well.

An organism may be defined as an assembly of molecules functioning as a more or less stable whole that exhibits the properties of life.

Dictionary definitions can be broad, using phrases such as "any living structure, such as a plant, animal, fungus or bacterium, capable of growth and reproduction".

**Many definitions exclude viruses** and possible man-made non-organic life forms, as viruses are dependent on the biochemical machinery of a host cell for reproduction.

**A superorganism** is an organism consisting of many individuals working together as a single functional or social unit.

### 1.3. NON-CELLULAR LIFE

Viruses are not typically considered to be organisms because they are incapable of autonomous reproduction, growth or metabolism.

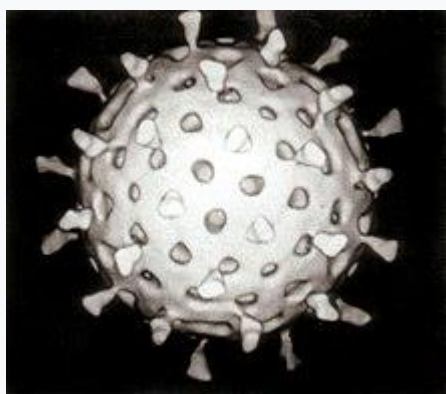
This controversy is problematic because some cellular organisms are also incapable of independent survival (but are capable of independent metabolism and procreation) and live as obligatory intracellular parasites.

Although viruses have a few enzymes and molecules characteristic of living organisms, they have no metabolism of

their own; they cannot synthesize and organize the organic compounds from which they are formed.

Naturally, this rules out autonomous reproduction: they can only be passively replicated by the machinery of the host cell. In this sense, they are similar to inanimate matter.

While viruses sustain no independent metabolism, and thus are usually not classified as organisms, they do have their own genes, and they do evolve by mechanisms similar to the evolutionary mechanisms of organisms.



[Rotavirus](#)

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. These interactions result in emergent

properties at a higher level of organisation. This phenomenon is true in the hierarchy of organisational complexity at all levels.

Therefore, we can say that living organisms are self-replicating, evolving and self-regulating interactive systems capable of responding to external stimuli.

In 2008, the J. Craig Venter Institute assembled a synthetic bacterial genome, ***Mycoplasma genitalium***, by using recombination in yeast of 25 overlapping DNA fragments in a single step. The use of yeast recombination greatly simplifies the assembly of large DNA molecules from both synthetic and natural fragments.

Other companies, such as Synthetic Genomics, have already been formed to take advantage of the many commercial uses of custom designed genomes.

## 1.4 DIVERSITY IN THE LIVING WORLD

### 1.5 TAXONOMIC DIVERSITY

Biodiversity also refers to the number, or abundance of different species living within a particular region. It represents the wealth of biological resources available to us. It's all about the sustaining the natural area made up of community of plants, animals, and other living things that is begin reduced at a steady rate as we plan human activities that is being reduced by habitat destruction.

- taxonomic diversity (usually measured at the species diversity level)
- ecological diversity (often viewed from the perspective of ecosystem diversity)
- morphological diversity (which stems from genetic diversity and molecular diversity)
- functional diversity (which is a measure of the number of functionally disparate species within a population (e.g. different feeding mechanism, different motility, predator vs prey, etc.

For plants, scientific names are based on agreed principles and criteria, which are provided in International Code for Botanical

Nomenclature (ICBN). You may ask, how are animals named?

Animal taxonomists have evolved International Code of Zoological Nomenclature (ICZN). The scientific names ensure that each organism has only one name. Description of any organism should enable the people (in any part of the world) to arrive at the same name. They also ensure that such a name has not been used for any other known organism.

Binomial nomenclature ("two-term naming system") also called binominal nomenclature ("two-name naming system") or binary nomenclature, is a formal system of naming species of living things by giving each a name composed of two parts, both of which use Latin

grammatical forms, although they can be based on words from other languages. Such a name is called a binomial name (which may be shortened to just "binomial"), a binomen, binominal name or a scientific name; more informally it is also called a Latin name.

- ➔ The first part of the name identifies the genus to which the species belongs; the second part – the specific name or specific epithet – identifies the species within the genus. For example, humans belong to the genus *Homo* and within this genus to the species *Homo sapiens*. *Tyrannosaurus rex* is probably the most widely known binomial.
- ➔ The formal introduction of this system of naming species is credited to Carl Linnaeus, effectively beginning with his work *Species Plantarum* in 1753.
- ➔ But Gaspard Bauhin, in as early as 1623, had introduced in his book *Pinax theatri botanici* (English, Illustrated exposition of plants) many names of genera that were later adopted by Linnaeus.

*"Amaranthus retroflexus L."* – "L." is the standard abbreviation used in botany for "Linnaeus"

Taxonomy includes both nomenclature and classification. Its first stages (sometimes called "alpha taxonomy") are concerned with finding, describing and naming species of living or fossil organisms.[]

mango is written as *Mangifera indica*.

Other universal rules of nomenclature are as follows:

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.

### 1.5.1 CLASSIFICATION.

Classification is the process by which anything is grouped into convenient



categories based on some easily observable characters. For example, we easily recognise groups such as plants or animals or dogs, cats or insects.

The abbreviation "sp." is used when the actual specific name cannot or need not be specified. The abbreviation "spp." (plural) indicates "several species". These abbreviations are not italicised (or underlined). For example: "Canis sp." means "an unspecified species of the genus Canis", while "Canis spp." means "two or more species of the genus Canis". (The abbreviations "sp." and "spp." can easily be confused with the abbreviations "ssp." (zoology) or "subsp." (botany), plurals "sspp." or "subssp.", referring to one or more subspecies.

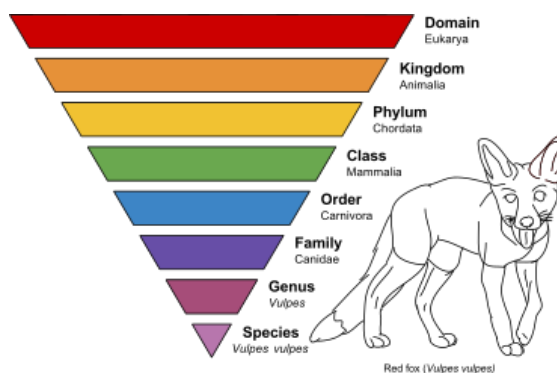
based on characteristics, all living organisms can be classified into different taxa. This process of classification is taxonomy. External and internal structure, along with the structure of cell, development

process and ecological information of organisms are essential and form the basis of modern taxonomic studies. Hence, characterisation, identification, classification and nomenclature are the processes that are basic to taxonomy

Human beings were, since long, not only interested in knowing more about different kinds of organisms and their diversities, but also the relationships

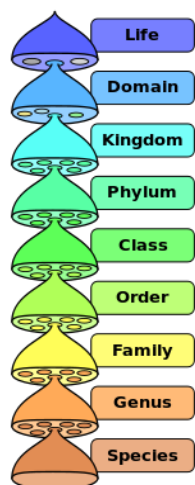
among them. This branch of study was referred to as systematics. The word systematics is derived from the Latin word 'systema' which means systematic arrangement of organisms. Linnaeus used *Systema Naturae* as the title of his publication. The scope of systematics was later enlarged to include identification, nomenclature and classification. Systematics takes into account evolutionary relationships between organisms.

#### TAXONOMIC RANK



The major ranks: domain, kingdom, phylum, class, order, family, genus, and species, applied to the [red fox](#), *Vulpes vulpes*





The hierarchy of biological classification's eight major taxonomic ranks. Intermediate minor rankings are not shown.

In biological classification, taxonomic rank is the relative level of a group of organisms (a taxon) in a taxonomic hierarchy. Examples of taxonomic ranks are species, genus, family, order, class, phylum, kingdom,

A taxon is usually assigned a rank when it is given its formal name. The basic ranks are species and genus. When an organism is given a species name it is assigned to a genus, and the genus name is part of the species name.

The species name is also called a binomial, that is, a two-term name. For example, the zoological name for the human species is *Homo sapiens*. This is usually italicized in print and underlined when italics are not available. In this case, *Homo* is the generic name and it is

capitalized; *sapiens* indicates the species and it is not capitalized.

Names of Some Plants Using Binomial Nomenclature:

Sr. No. Common Name Scientific Name

1 Apple *Pyrus malus*

2 Brinjal *Solanum melongena*

3 Cabbage *Brassica oleracea*

4 Carrot *Daucus carota*

5 Ginger *Zingiber oicinale*

6 Grape vine *Vitis vinifera*

7 Mango *Mangifera indica*

8 Neem *Azadirachta indica*

9 Pea *Pisum sativum*

10 Pear *Pyrus communis*

11 Potato *Solanum tuberosum*

12 Tamarind *Tamarindus indica*

13 Wheat *Triticum aestivum*

14 Rice *Oryza sativa*

15 Maize *Zea Mays*

16 Jowar *Sorghum bicolor*

17 Bajra *Pennisetum glaucum*

18 Sunflower *Helianthus annuus*

19 China rose *Hibiscus rosa-sinensis*



20 Jute *Corchorus capsularis*

### **Names of Some Animals Using Binomial Nomenclature:**

Sr. No. Common Name Scientific Name

1 Cobra *Naja naja*

2 Cockroach *Periplaneta americana*

3 Dog *Canis familiaris*

4 Wolf *Canis lupus*

5 Domestic cat *Felis domestica*

6 Earthworm *Pheretima posthuma*

7 Frog *Rana tigrina*

8 Lion *Panthera leo*

9 Tiger *Panthera tigris*

10 Leopard *Panthera pardus*

11 Snow leopard *Panthera uncia*

12 Honey bee *Apis mellifera*

13 House fly *Musca nebulosa*

14 House sparrow *Passer domestica*

15 Horse *Equus caballus*

16 Human *Homo sapiens*

17 Indian Elephant *Elephas maximus-indicus*

18 African Elephant *Loxodonta africana*

19 Rat *Rattus rattus*

20 Fox *Vulpes vulpes*

21 Silk worm *Bombyx mori*

22 Tape worm *Taenia solium*

Sir Julian Huxley (1940):

He introduced the term 'New Systematics' for the classification of living organisms based on the theory of evolution and phylogeny.

### **CLASSIFICATION AND ITS NEED:**

The term classification was coined by A. P. de Condole.

Classification is the process by which anything is grouped into convenient categories based on some easily observable characters. There are a large number of organisms found on the Earth.

They show variations in their shape, size, structure, habit, habitat, nutrition, etc. It is difficult to remember the characteristics of all the organisms without their proper arrangement. The classification helps us to explain unity in diversity of the organisms. The classification places an organism amongst those which have common characteristics. Systematics and Taxonomy:

### **SYSTEMATICS:**

Systematics is a scientific study of similarities and differences among different kinds of organisms and also includes identification, nomenclature, and classification.

### **TAXONOMY:**

It is the branch of biology which deals with the collection, identification, nomenclature, description, and classification of plants and animals.

Generally, the terms taxonomy, systematics and classification are used interchangeably. But Simpson said that these are three separate fields of study and should not be confused with each other.

## **1.6. NEW SYSTEMATICS OR MODERN SYSTEMATICS:**

The term new systematics was coined by Julian Huxley (1940).

New systematics is the systematic study which takes into consideration all types of characters including those from classification morphology, anatomy, cytology, physiology, biochemistry, ecology, genetics, development (embryology), behaviour, etc. of the whole population instead of a few typological specimens.

### **1.6.1 CHARACTERISTICS OF NEW SYSTEMATICS:**

Importance is given to subspecies and population instead of species. The biological definition is replaced by morphological definition.

It considers other branches of biology like cytology, physiology, biochemistry, genetics, etc.

New systematics is based on the study of all types of variations in the species. Along with morphological characters, other

investigations are also carried out to know the variety of traits.

Delimitation of species is carried out on the basis of all types of biological traits. It is also called **biological delimitation**.

Statistical data and techniques are used to know the traits in the degree of primitiveness, advancement and to find Inter-relationships. According to new systematics, species is not fixed or static but highly dynamic.

### **1.6.2 BASICS OF SYSTEMATICS:**

#### **A) CHARACTERIZATION:**

The organism to be studied is described for all its morphological and other characteristics. Identification: Based on the studied characteristics, the identification of the organism is carried out to know whether it is similar to any of the known group or taxa.

#### **B) CLASSIFICATION:**

The organism is now classified on the basis of its resemblance to different taxa. It is the arrangement of organisms into

groups based on their relationship. If the organism cannot be classified under known groups, then a new group or taxon is created to accommodate it.

### C) NOMENCLATURE:

After placing the organism in various taxa, its correct name is determined. Objectives of Systematics and Taxonomy: To know various kinds of plants on the earth with their names, affinities, geographical distribution, habit, characteristics and their economic importance. To have a reference system for all organisms with which scientists can work. To demonstrate manifold diversities of organisms and

their phylogenetic (evolutionary) relationship. To ascertain nomenclature.

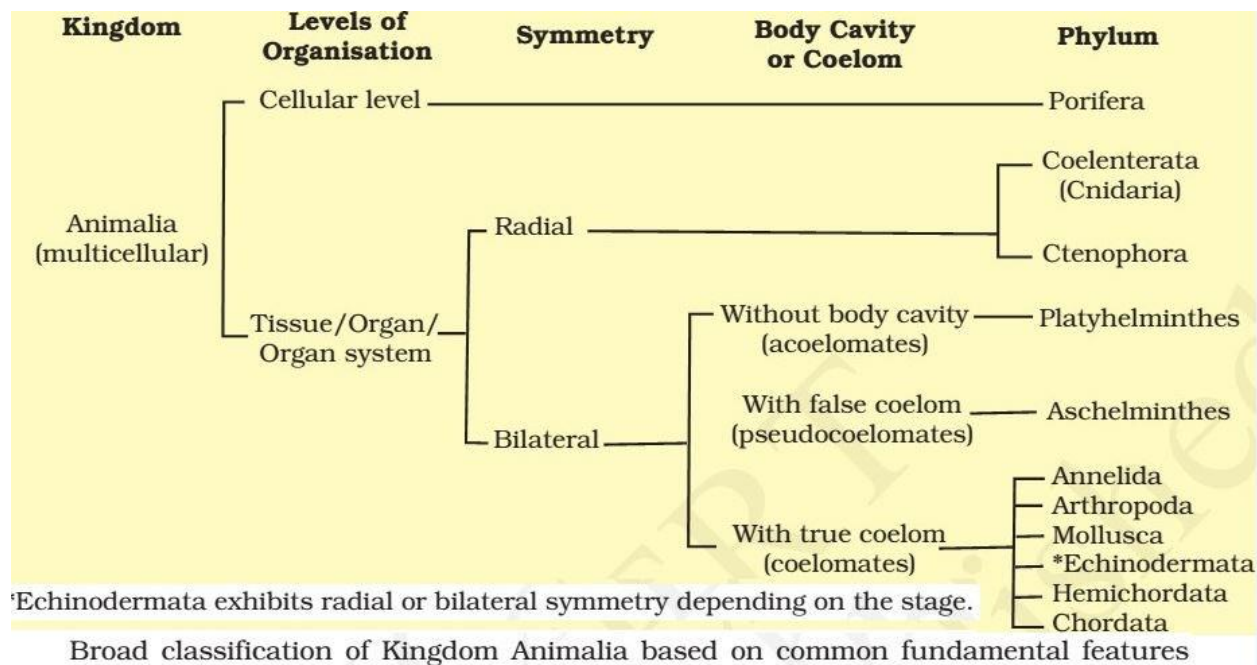
**Phylogeny:** The evolutionary history of a particular species is called phylogeny. Classification based on their phylogenetic relationship or on the basis of evolution is called evolutionary or phylogenetic classification. Many groups of organisms are now extinct, and without their fossils, we would not have a picture of how modern life is interrelated. We express the relationships among groups of organisms through diagrams called cladograms, which are like genealogies of species.

**TABLE 1.1 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

Characters	Five Kingdoms				
	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell wall	Noncellulosic (Polysaccharide + amino acid)	Present in some	Present (without cellulose)	Present (cellulose)	Absent
Nuclear membrane	Absent	Present	Present	Present	Present
Body organisation	Cellular	Cellular	Multicellular/ loose tissue	Tissue/ organ	Tissue/organ/ organ system
Mode of nutrition	Autotrophic (chemosynthetic and photosynthetic) and Heterotrophic (saprophytic/parasitic)	Autotrophic (Photosynthetic) and Heterotrophic	Heterotrophic (Saprophytic/ Parasitic)	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic/ Saprophytic etc.)

Common Name	Scientific Name	Genus	Family	Order	Class	Phylum Division	Kingdom
Human	Homo sapiens	Homo	Hominide	Primata	Mammalia	Chordata	Animalia
Dog	Canis Familiaris	Canis	Canidae	Carnivora	do	do	do
House fly	Musca domestica	Musca	Muscidae	Diptera	Insecta	Arthropoda	do
Mango	Mangifera indica	Mangifera	Anacardiaceae	Sapindales	Dicotyledonae	Angiospermae	Plantae
Tulsi	Ocimum sanctum	ocimum	Lamiaceae	Lamiales	do	do	do
Wheat	Triticum aestivum	Triticum	poaceae	poales	Monocotyledonae	do	do



## Linnaeus's System of Classification

Linnaeus' system uses seven taxonomic categories

species breeding population

genus group of closely related species

family genera that share many characteristics i.e., Ursidae

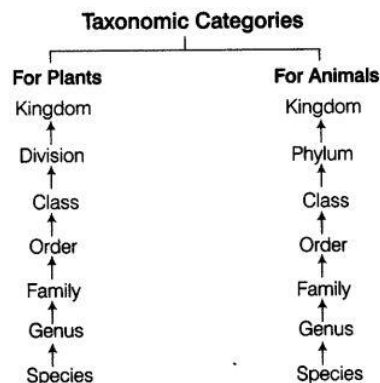
order broad category of similar families i.e., Carnivora

class similar orders i.e., Mammalia

phylum very different organisms that share some important characteristics i.e., Chordata

Kingdom Linnaeus named just two, plants and animals

## TAXONOMICAL AIDS



**Fig. 1.3** Taxonomic categories showing hierarchical arrangement in ascending order

Taxon	Category
A taxon deals with real biological objects.	A category is an abstract term that simply represents a rank or level in classification.
Taxon may belong to any ranking.	It belongs to one particular ranking.
e.g., The taxon of humans is <i>mammalia</i> .	e.g., The category of humans is <i>class</i> .



Category	Standard Suffix
Kingdom	Plantae (No fixed suffix)
Division	–phyta
Class	–ae
Order	–ales
Family	–aceae
Genus	No fixed suffix
Species	No fixed suffix

**TABLE 3.1. Taxonomic ranks or levels in ascending order**

Rank or level	Example
Species	<i>E. coli</i>
Genus	<i>Escherichia</i>
Family	Enterobacteriaceae
Order	Enterobacteriales
Class	γ-Proteobacteria
Phylum	Proteobacteria
Domain	Bacteria

A breakdown of the animal kingdom reveals many phyla

- SIMPLE ANIMALS {
- **Porifera** - sponges
  - **Cnidaria** – jellyfish, coral
  - **Platyhelminthes** – flat worms
  - **Nematoda** – round worms
  - **Annelida** – segmented worms
  - **Mollusca** – clams, snails, squid
  - **Echinodermata** - starfish
  - **Arthropoda** – insect, spider, crustacean
  - **Chordata** – frogs, fish, humans

## 1.7 TAXONOMICAL AIDS

Specimens are collected from various sources and the information gathered is stored. Biologists have established certain procedures and techniques to store and preserve the information as well as the

specimens. This information is known as **taxonomical aids** because it helps the biologists in taxonomic studies. Some taxonomical aids are as follows-



## A) HERBARIUM

Herbarium is a store house of collected plant specimens that are dried, pressed and preserved on sheets. Further, these sheets are arranged. **Taxonomical** aids act as a quick reference system in the taxonomical study. A professor of Botany, Luca Ghini, set up the **first herbarium at Pisa in Italy**. Now from small personal collections, herbaria have grown into large institutions of national and international importance.

British Museum, which is especially rich in the earlier collections made in the eighteenth and early nineteenth centuries,

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*Modern herbaria often maintain electronic databases of their collections. Many herbaria have initiatives to **DIGITIZE SPECIMENS** to produce a virtual herbarium. These **records** and images are made publicly accessible via the Internet when possible.*

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The same term is often used in mycology to describe an equivalent collection of preserved fungi, otherwise known as a **fungarium**.

A **xylarium** is a herbarium specialising in specimens **of wood**.

**The term hortorium** (as in the Liberty Hyde Bailey Hortorium) has occasionally been applied to a herbarium specialising in preserving material of horticultural origin.

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*Certain groups of plants are soft, bulky, or otherwise not amenable to drying and mounting on sheets. For these plants, other methods of preparation and storage may be used. For example, conifer cones and palm fronds may be stored in labelled boxes. Representative flowers or fruits may be pickled in formaldehyde to preserve their three-dimensional structure. Small specimens, such as mosses and lichens, are often air-dried and packaged in small paper envelopes.*

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No matter the method of preservation, detailed information on where and when the plant was collected, habitat, color (since it may fade over time), and the name of the collector is usually included.

## B) BOTANICAL GARDENS

The Botanical Garden is a place where plants from various groups are grown for scientific study, conservation, public education, aesthetics, and Recreation. They usually house library, laboratory, herbarium, and museum. They also offer teaching and training of facilities.

The government or private organizations maintain the botanical gardens. These organizations also employ botanist and gardeners to look after the plants. Some famous botanical gardens are at

- a) 1-Kew England,
- b) 2-Indian Botanical garden Howrah,
- c) 3-National botanical research institute Lucknow etc.
- d) 4.- Virtual Herbarium of the Botanic Garden and Botanical Museum Berlin-Dahlem, Freie Universität Berlin
- e) 5-The Virtual Herbarium at The New York Botanical Garden
- f) 6-JSTOR Plant Science
- g) 7-Reflora Virtual Herbarium
- h) 8-Moscow Digital Herbarium: 786K scans online
- i) 9-Harvard University Herbaria & Libraries
- j) 10-Digital Herbarium of Angiospermic Plants of Western Ghat Regions of Maharashtra

Digital Herbarium of Selected Indian Medicinal Plants.

## C) MUSEUM

Biological museums are generally set up in educational institutes such as schools and colleges.

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.

## C) 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 behaviour.

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

Children love visiting these parks, commonly called Zoos.

The abbreviation "zoo" was first used of the London Zoological Gardens, which

was opened for scientific study in 1828 and to the public in 1857. The number of major animal collections open to the public around the world now exceeds to 1,000, around 80 percent of them are in cities.

The term "biopark" was first coined and developed by the National Zoo in Washington D.C. in the late 1980s.

In 1993, the New York Zoological Society changed its name to the Wildlife Conservation Society and rebranded the zoos under its jurisdiction as "wildlife conservation parks.

There are over 300 zoological gardens in India. The fundamental object of any Zoological Park is to increase the public interest in the understanding of wildlife.

#### **D) KEYS**

The term key refers to a set of alternate characters in such a manner that helps in the identification of plants and animals by selecting and eliminating the characters according to their presence or absence in the organism. Different categories use different keys. Each statement in the key is called lead. For example key for identification of animals are as follows:

Ear wings and mammary glands are present– bat

Beak, feathers, wings are present — birds

Mammary glands, pinna. and scales are absent. Limbs and slimy skin is present – Frog

#### **E) SOME OTHER TAXONOMIC AIDS**

Certain written documents, as well as recording descriptions like flora, manuals, monograph and, catalogues, are used as taxonomic aids. They also help incorrect identification of particular species. Flora consists of complete account and distribution of plants in a given area. This provides information regarding the different types of plant species found in a given area. Monograph contain information on any taxon.

Question: Botanical gardens and zoological parks have a collection of

- a) endemic living species only
- b) exotic living species only
- c) endemic and exotic living species
- d) only local plants and animals

Answer: (c) Collection of endemic and exotic living species. Explanation: To understand this, you can visit the zoo at Delhi or Kolkata. You can also search in Google image and you will find giraffes; along with tigers and lions. Tigers and lions are endemic species while giraffe is an exotic species.

#### **F) SAFARI PARK**

Some zoos keep animals in larger, outdoor enclosures, confining them with moats and fences, rather than in cages. Safari parks, also known as zoo parks and lion farms, allow visitors to drive through them and come in close proximity to the animals. Sometimes, visitors are able to feed animals through the car windows. The first safari park was Whipsnade Park in Bedfordshire, England, opened by the Zoological Society of London in 1931 which today (2014) covers 600 acres (2.4 km<sup>2</sup>). Since the early 1970s, a 1,800 acre (7 km<sup>2</sup>) park in the San Pasqual Valley near San Diego has featured the San Diego Zoo Safari Park, run by the Zoological Society of San Diego. One of two state-supported zoo parks in North Carolina is the 2,000-acre (8.1 km<sup>2</sup>) North Carolina Zoo in Asheboro. The 500-acre (2.0 km<sup>2</sup>) Werribee Open Range Zoo in Melbourne, Australia, displays animals living in an artificial savannah.

Ex situ conservation literally means, "off-site conservation". It is the process of protecting an endangered species, variety or breed, of plant or animal outside its natural habitat; for example, by removing part of the population from a threatened habitat and placing it in a new location, which may be a wild area or within the care of humans.

Agricultural biodiversity is also conserved in ex situ collections. This is primarily in

the form of gene banks where samples are stored in order to conserve the genetic resources of major crop plants and their wild relatives.

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*The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies*

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#### Conservation status

by IUCN Red List category

*Bufo perigrinus*, the Golden Toad, was last recorded on May 15, 1989

- ➔ Extinct
- ➔ Extinct (EX)
- ➔ Extinct in the Wild (EW)
- ➔ Threatened
- ➔ Critically Endangered (CR)
- ➔ Endangered (EN)
- ➔ Vulnerable (VU)
- ➔ Lower Risk
- ➔ Near Threatened (NT)
- ➔ Conservation Dependent (CD)
- ➔ Least Concern (LC)

#### **G) OTHER CATEGORIES**

Species are classified by the IUCN Red List into nine groups,[15] specified through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

- a) Extinct (EX) – No known individuals remaining
- b) Extinct in the wild (EW) – Known only to survive in captivity, or as a naturalized population outside its historic range
- c) Critically endangered (CR) – Extremely high risk of extinction in the wild
- d) Endangered (EN) – High risk of extinction in the wild
- e) Vulnerable (VU) – High risk of endangerment in the wild
- f) Near threatened (NT) – Likely to become endangered in the near future
- g) Least concern (LC) – Lowest risk (Does not qualify for a more at-risk category; widespread and abundant taxa are included in this category.)
- h) Data deficient (DD) – Not enough data to make an assessment of its risk of extinction

Not evaluated (NE) – Has not yet been evaluated against the criteria

## MCQ FOR PRACTICE

1. IDENTIFY FROM THE FOLLOWING, THE ONLY TAXONOMIC CATEGORY THAT HAS A REAL EXISTENCE.

- a) Phylum
- b) Species
- c) Genus
- d) Kingdom

B

2. IN FIVE KINGDOM SYSTEM, THE MAIN BASIS OF CLASSIFICATION IS

- a) Structure of cell wall
- b) Nutrition
- c) Structure of nucleus
- d) Asexual reproduction

B

3. IN WHICH KINGDOM WOULD YOU CLASSIFY THE ARCHAEA AND NITROGEN-FIXING ORGANISM, IF THE FIVE-KINGDOM SYSTEM OF CLASSIFICATION IS USED

- a) Protista
- b) Fungi
- c) Plantae
- d) Monera

D

4. THE PHYLOGENETIC SYSTEM OF CLASSIFICATION WAS PUT FORTH BY

- a) Theophrastus
- b) George Bentham and Joseph Dalton Hooker
- c) Carolus Linnaeus
- d) Adolf Engler and Karl Prantl

D

5. WHICH SERIES ENDS WITH THE COHORT UMBELLALES IN BENTHAM AND HOOKER'S SYSTEM OF CLASSIFICATION?

- a) Heteromerae
- b) Disciflorae
- c) Thalamiflorae
- d) Calyciflorae

D

6. WHICH ONE OF THE TAXONOMIC AIDS CAN GIVE COMPREHENSIVE ACCOUNT OF COMPLETE COMPILED INFORMATION OF ANY ONE GENUS OR FAMILY AT A PARTICULAR TIME?

- a) Taxonomic key
- b) Flora
- c) Herbarium
- d) Monograph

D

7. A PERENNIAL SHRUB HAS COMPOUND LEAVES AND SOLITARY ZYGOMORPHIC AND EPIGYNOUS FLOWERS. EACH FLOWER REVEALS DICHLAMYDEOUS CONDITION WITH MANY STAMENS AND MULTIPLE FRUIT WITH EXALBUMINOUS SEEDS. WHAT IS THE RATIO OF ADVANCED AND PRIMITIVE CHARACTERS IN IT?

- a) 1: 2
- b) 2: 3
- c) 1: 1
- d) 3: 2

C

8. CLASSIFICATION OF ORGANISMS BASED ON EVOLUTIONARY AS WELL



AS GENETIC RELATIONSHIPS IS CALLED

- a) Numerical taxonomy
- b) Phenetics
- c) Biosystematics
- d) Cladistics

D

9. PHENETIC CLASSIFICATION OF ORGANISMS IS BASED ON

- a) Sexual characteristics
- b) Dendrogram based on DNA characteristics
- c) The ancestral lineage of existing organisms
- d) Observable characteristics of existing organisms

D

10. IN ANGIOSPERM, CHARACTERS OF FLOWERS ARE USED IN CLASSIFICATION BECAUSE

- a) Flowers are attractive
- b) Flowers are large
- c) Characters of flowers are conservative
- d) None of the above

C

11. BIOSYSTEMATICS AIMS AT

- a) Identification and arrangement of organisms on the basis of cytological characteristics
- b) The classification of organisms based on broad morphological characters

B

- c) Delimiting various taxa of organism and establishing their relationships
- d) The classification of organisms based on their evolutionary history and establishing their phylogeny on the totality of various parameters from all fields of studies

D

12. PRACTICAL PURPOSE OF TAXONOMY OR CLASSIFICATION

- a) To know the evolutionary history
- b) Explain the origin of organisms
- c) Facilitate the identification of unknown species
- d) Identification of medicinal plants

C

13. TWO PLANTS CAN BE CONCLUSIVELY SAID TO BELONG TO THE SAME SPECIES IF THEY

- a) Have more than 90 percent similar genes
- b) Can reproduce freely with each other and form seeds
- c) Have same number of chromosomes
- d) Look similar and possess identical secondary metabolites

14. ONE OF THE MOST IMPORTANT FUNCTIONS OF BOTANICAL GARDENS IS THAT

- a) One can observe tropical plants there

- b) They provide the natural habitat for wild life
- c) They allow ex-situ conservation of germplasm
- d) They provide a beautiful area for recreation

C

15. WHICH OF THE FOLLOWING IS A MERIT IN THE BENTHAM AND HOOKER'S SYSTEM OF CLASSIFICATION?

- a) The placement of family - Asteraceae in the beginning of Gamopetalae
- b) The placement of order - Ranals in the beginning
- c) Closely related families are placed apart
- d) The position of gymnosperms in between dicots and monocots

B

## SET 2

1. AS WE GO FROM SPECIES TO KINGDOM IN A TAXONOMIC HIERARCHY, THE NUMBER OF COMMON CHARACTERISTICS

- a. Will decrease
- b. Will increase
- c. Remain same
- d. May increase or decrease

2. WHICH OF THE FOLLOWING 'SUFFIXES' USED FOR UNITS OF CLASSIFICATION IN PLANTS INDICATES A TAXONOMIC CATEGORY OF 'FAMILY'.

- a. – Ales
- b. – Onae
- c. – Aceae
- d. – Ae

3. THE TERM 'SYSTEMATICS' REFERS TO:

- a. Identification and classification of plants and animals
- b. Nomenclature and identification of plants and animals
- c. Diversity of kinds of organisms and their relationship
- d. Different kinds of organisms and their classification

4. GENUS REPRESENTS

- a. An individual plant or animal
- b. A collection of plants or animals
- c. Group of closely related species of plants or animals
- d. None of these

5. THE TAXONOMIC UNIT 'PHYLUM' IN THE CLASSIFICATION OF ANIMALS IS EQUIVALENT TO WHICH HIERARCHICAL LEVEL IN CLASSIFICATION OF PLANTS

- a. Class
- b. Order
- c. Division
- d. Family

6. BOTANICAL GARDENS AND ZOOLOGICAL PARKS HAVE

- a. Collection of endemic living species only
- b. Collection of exotic living species only
- c. Collection of endemic and exotic living species
- d. Collection of only local plants and animals

7. TAXONOMIC KEY IS ONE OF THE TAXONOMIC TOOLS IN THE IDENTIFICATION AND CLASSIFICATION OF PLANTS AND ANIMALS. IT IS USED IN THE PREPARATION OF

- a. Monographs
- b. Flora
- c. Both a & b
- d. None of these

8. ALL LIVING ORGANISMS ARE LINKED TO ONE ANOTHER BECAUSE

- a. They have common genetic material of the same type
- b. They share common genetic material but to varying degrees
- c. All have common cellular organization
- d. All of above

9. WHICH OF THE FOLLOWING IS A DEFINING CHARACTERISTIC OF LIVING ORGANISMS?

- a. Growth
- b. Ability to make sound
- c. Reproduction
- d. Response to external stimuli

Answers to Multiple Choice Questions 1-a; 2-c; 3-c; 4-c; 5-c; 6-c; 7-c; 8-d; 9-d; 10-a

Q1) A group of plants or animals with similar traits of any rank is ... [ AFMC 2011]

- a) Species
- b) Genus
- c) Order

d) Taxon

D

Q2) Assertion(a): The “biological species” concept help us to ask how species are formed.

Reason (r) : The concept of biological species focuses our attention on the question of how reproductive isolation comes about.

a) both (a) and (r) are correct but r does not explains a

b) both (a) and (r) are correct and (r) is true explanation of a

c) Both (a) and (r) are not true

d) Only (a) is true, (r) is not correct

D

Q3) In fish *Catla catla*, the specific name is identical with the generic name.

It is an example of ... .. [ AMU 2012 [

a) Autonym

b) Tautonym

c) Phylum

d) Species

B

Q4) In nomenclature ... [ MPPMT 1993]

a) Both genus and species are printed italics

b) Genus and species may be of same name

c) Both in genus and species the first letter is capital

d) Genus is written after the species

A

Q5) Pesticide used in preparation of herbarium ... [ KJCMEE 2010 ]

a) 2, 4-D

b) NAA

c) Mercuric chloride

d) Carbon disulphide

C

International code of ‘Biological Nomenclature’ is applicable to ... .. [ DPMT1992]

a) Viruses

b) Plants

c) Animals

d) Both B and C

D

Five kingdom system of classification suggested by

R.H.Whittaker is not based on :  
...[AIPMT 2014]

- a) Mode of nutrition
- b) Complexity of body organization
- c) Presence of absence of a well-defined nucleus.
- d) Mode of reproduction.

A

The label of a herbarium sheet does not carry information on : ...[NEET 2016]

- a) Local names
- b) height of the plant
- c) date of collection
- d) name of collector

A

Study the four statements (A–D) given below and select the two correct ones out of them : ...[NEET 2016]

- (A) Definition of biological species was given by Ernst Mayr.
- (B) Photoperiod does not affect reproduction in plants.
- (C) Binomial nomenclature system was given by R.H. Whittaker.
- (D) In unicellular organisms, reproduction is synonymous with growth.

The two correct statements are

- a) A and D
- b) A and B
- c) B and C
- d) C and D

A

TRY AND PRACTICE BY OWN

Q1) Which of the following is less general in characters as compared to genus ... [ CBSE 2001]

1 point

- a) Species
- b) Family
- c) Class
- d) Division

Q2) Which of the following combinations is correct for Wheat?  
.... [ DPMT 2009]

1 point

- a) Genus Triticum, family Poaceae , order Poales, Class Dicotyledonae
- b) Genus Triticum, family Poaceae , order Sapindales, class Monocotyledonae.
- c) Genus Triticum, family Poaceae , order Poales, Class Monocotyledonae.
- d) Genus Triticum , family Anacardiaceae, order Poales, class Monocotyledonae

Q3) A group of plants or animals with similar traits of any rank is ...  
[ AFMC 2011]

1 point

- a) Species
- b) Genus
- c) Order
- d) Taxon

Q4) In fish *Catla catla*, the specific name is identical with the generic name. It is an example of ... .. ( AMU 2012 )

1 point

- a) Autonym
- b) Tautonym
- c) Phylum
- d) Species

Q5) Which is the correct sequence of taxonomic categories? ...[ HPPMT 2010]

1 point

- a) Species → genus → order → phylum
- b) Species → order → phylum → kingdom
- c) genus → Species → order → kingdom
- d) None of the above

Q6) Linnaeus is credited with ... .. [ BHU 1991 ]

1 point

- a) Binomial nomenclature
- b) Theory of biogenesis
- c) Discovery of microscope
- d) Discovery of blood circulation

Q7) Metabolism is ... .. [ Har PMT 2005]

1 point

- a) Release of energy
- b) Gain of energy
- c) Release or gain of energy
- d) Catabolism of a reaction

Q8) Which of the following is the hierarchical sequence

1 point

- a) Phylum, class, order, family
- b) Phylum, division, family, class
- c) Genus, species, order, family
- d) Division, order, class, genus.

Q9) In nomenclature ... [ MPPMT 1993]

1 point

- a) Both genus and species are printed italics
- b) Genus and species may be of same name
- c) Both in genus and species the first letter is capital
- d) Genus is written after the species

Q10) Identify from the following the only category that has a real existence

1 point

- a) Phylum
- b) Kingdom
- c) Genus
- d) Species

Q11) Binomial nomenclature means ... ..[AMU 1995]

1 point



- a) One name given by scientists
- b) One scientific name consisting of a generic and specific epithet
- c) Two name, one latinised, other of a person
- d) Two names, one scientific, other local

Q12) Assertion : Death is regarded as the most regulatory process on earth. Reason: It avoids overcrowding caused by continuous reproduction ... .. [ AIIMS 2002 ]

1 point

- a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- b) The Assertion and Reason are true but Reason is not correct explanation of Assertion
- c) Assertion is true but, Reason is false
- d) Assertion is false but, Reason is true

Q13) Binomial nomenclature was introduced by .... [ BHU 1991 ]

1 point

- a) De Vries
- b) Carolus Linnaeus
- c) Huxley
- d) John Ray

Q14) Which one of the following has least similar character? ... .. [ DPMT 1999 ]

1 point

- a) Family
- b) Class

- c) Genus
- d) Species

Q15) Animals are classified into hierarchical groups. In which one of the following the largest number of species is found. ... [ W.B. 2012 ]

1 point

- a) Genus
- b) Order
- c) Family
- d) Cohort

Q16) Sequence of taxonomic categories is .... [ AFMC 1992 ]

1 point

- a) Class – Phylum – tribe – Order – family -genus – Species
- b) Division – Class – Family – tribe – Order – Genus – Species
- c) Division – Class – Order – Family – Tribe – Genus – Species
- d) Phylum – Order – Class – Tribe – Family – Genus – Species

Q17) A taxon is

1 point

- a) A group of related families
- b) A group of related species
- c) A type of living organisms
- d) A taxonomic group of any ranking

Q18) The generic name of Mango is ... .. [ HPPMT 2011 ]

1 point

- a) *Mangifera indica*
- b) *Indica*

- c) Mangifera
- d) Indica Mangifera

Q19) Which is an exclusive trait of living things ... [ CBSE 2011]

1 point

- a) Isolated metabolic reactions occur in vitro
- b) Increase in mass from inside body
- c) Perception of events happening in the environment and their memory
- d) Increase in mass by accumulation of material both on surface as well as internally.

Q20) Which taxonomic aid gives comprehensive account of complete compiled information of genus or family at a particular time? [ Kerala 2009]

1 point

- a) Taxonomic key
- b) Herbarium
- c) Monograph
- d) Flora

Q21) ICBN is ... .. [ DPMT 2003]

1 point

- a) International Code of Biological Naming
- b) International Code of Biological Nomenclature
- c) International Class of Biological Nomenclature.
- d) International Classification of Biological nomenclature

Q22) International code of 'Biological Nomenclature' is applicable to ... .. [ DPMT1992]

1 point

- a) Viruses
- b) Plants
- c) Animals
- d) Both B and C

Q23) Binomial nomenclature consists of two words ... .. [ BHU 1999 ]

1 point

- a) Genus and species
- b) Order and family
- c) Family and genus
- d) Species and variety

Q24) Which of the following statements regarding universal rules of nomenclature is wrong ... [kerala 2010]

1 point

- a) Both the words in a biological name when hand written are separately underlined
- b) The first word in a biological name represents the genus
- c) The first word denoting the genus starts with a capital letter.
- d) Biological names are generally Greek and written in italics.

Q25) Which covers the largest number of organisms ..... [ Kerala 2001]

1 point

- a) Genus
- b) Family
- c) Phylum
- d) Class

Q26) Which of the following has correct specific epithet ... .. [ Odisha 2012 ]

1 point

- a) Indica mangifera
- b) Leo Panthera
- c) Canis familiaris
- d) Ascris

Q27) Specific epithet is .... [ Odisha 2012]

1 point

- a) First word in the scientific name of a species
- b) Second word in the scientific name of a species
- c) Both A and B
- d) None of the above

Q28) National Botanical Research Institute located in ... .. [ HPPMT 2010]

1 point

- a) Chennai
- b) Lucknow
- c) Kolkata
- d) Darjeeling

Q29) Systema Naturae was written by ...[ DPMT 2008 ]

1 point

- a) Lamarck
- b) Cuvier
- c) Aristotle
- d) Linnaeus

Q30) Which one of the following is a taxonomic aid for identification of plants and animals based on similarities and dissimilarities ... [ kerala 2012]

1 point

- a) Flora
- b) Keys
- c) Monographs
- d) Catalogues

Q31) Species are considered as ... [ CBSE 2003]

1 point

- a) Real basic unit of classification
- b) Lowest unit of classification
- c) Artificial concept of human mind which cannot be defined in absolute terms
- d) Real unit of classification devised by taxonomists

Q32) Carolus Linnaeus ( Carl Linne) was from ...[ Manipal 1997]

1 point

- a) Sweden
- b) UK
- c) Holland

d) France

Q33) A living organism can be unexceptionally differentiated from a non-living thing on the basis of its ability for ... .. [ CBSE 2007]

1 point

- a) Reproduction
- b) Growth and movement
- c) Responsiveness to touch
- d) Interaction with environment and progressive evolution

Q34) Which is matched correctly ... .. [ CBSE 2011]

1 point

- a) Humans – Primata – the family
- b) Housefly – Musca – an order
- c) Tiger – tigris – the species
- d) Cuttlefish – Mollusca – a class

Q35)

Q36) Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature? ...[AIPMT-2016]

1 point

- a) Biological names can be written in any language
- b) The first word in a biological name represents the genus name, and the second is a specific epithet
- c) The names are written in Latin and are italicised
- d) When written by hand, the names are to be underlined

Q37) Which one of the following is not a correct statement? [NEET 2013]

1 point

- a) Herbarium houses dried, pressed and preserved plant specimens
- b) Botanical gardens have collection of living plants for reference.
- c) A museum has collection of photographs of plants and animals.
- d) Key is a taxonomic aid for identification of specimens.

Q38) Which one of the following generates new genetic combinations leading to variation ? ...[NEET 2016]

1 point

- a) Sexual reproduction
- b) Nucellar polyembryony
- c) Vegetative reproduction
- d) Parthenogenesis