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BIOLOGY

LIVING WORLD

03

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IIT-JEE, NEET AND CBSE EXAMS

LIVING WORLD

PRACTICE SET

BIOLOGY

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03

Life is a unique, complex organization of molecules, expressing through chemical reactions which lead to growth, development, responsiveness, adaptation and reproduction.

PROPERTIES OF LIVING ORGANISMS

1. **Growth**
   - It is the increase in mass and number of cells.
   - In plants, growth by cell division occurs continuously throughout their life span.
   - In animals, growth is only up to a certain age. However, cell division occurs in certain tissues to replace lost cells.
   - Non-living objects grow by accumulation of material on the surface. In living organisms, growth is from inside.
2. **Reproduction**
   - It is the production of progeny similar to those of parents.
   - Organisms reproduce asexually and sexually.
   - Growth is the increase in cell number or mass. Hence in unicellular organisms, growth and reproduction are same.
   - Many organisms do not reproduce (e.g. mules, worker bees, infertile human couples, etc). Hence, reproduction is not a perfect defining characteristic of living organisms.
3. **Metabolism**
   - It is the sum total of all biochemical reactions taking place inside a living system.
   - Isolated metabolic reactions *in vitro* are not living things but are living reactions.
4. **Cellular organization**
   - All living organisms are made up of cells. They may be unicellular (single celled organism) or multicellular (multi celled organism).
5. **Consciousness**
   - It is this ability of organisms to sense their environment and respond to the environmental stimuli (like light, water, temperature, other organisms, chemicals, pollutants, etc.).
   - Therefore, all organisms are 'aware' of their surroundings.
   - Human is the only organism having **self-consciousness.**

Levels of Organization

The living world can be organized into different levels. For example, many individual organisms can be organized into the following levels:

- **Cell:** Cell is the basic unit of all living things.
- **Tissue:** Tissues are group of cells of the same kind.
- **Organ:** Organs are structure composed of one or more types of tissues.
- **Organ system:** They are group of organs that work together to do a certain job.
- **Organism:** Organisms constitutes individual living thing that may be made up of one or more organ systems.

There are also levels of organization above the individual organism. These levels are:

- **Population:** Organisms of the same species that live in the same area make up a population. For example, all of the goldfish living in the same area make up a goldfish population.
- **Community:** All of the populations that live in the same area make up a community. The community that includes the goldfish population also includes the populations of other fish, coral, and other organisms.

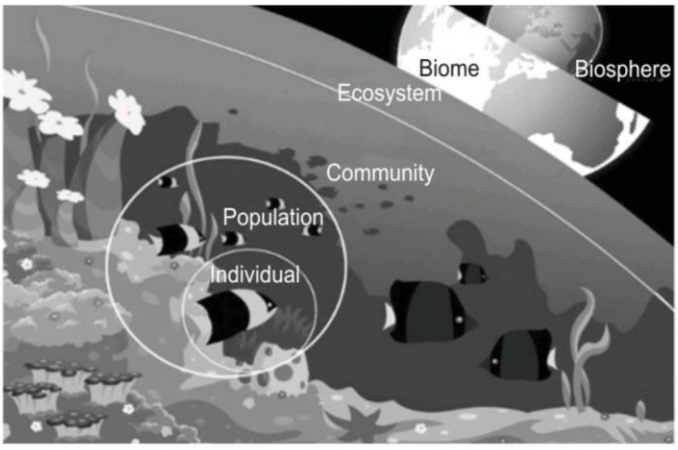


Fig. Levels of organization in nature, from the individual organism to the biosphere

- **Ecosystem:** An ecosystem consists of all the living things in a given area, together with the non-living environment. The non-living environment includes water, sunlight, and other physical factors.
- **Biome:** A group of similar ecosystems with the same general type of physical environment is called a biome.
- **Biosphere:** The biosphere is the part of earth where all life exists, including all the land, water, and air where living things can be found. The biosphere consists of many different biomes.

DIVERSITY IN THE LIVING WORLD

- The Biodiversity of the earth is enormous.
- **Biodiversity** is the term used to refer the number of varieties of plants and animals on earth. There is a great diversity among living organisms found on the planet earth. They differ in their structure, habit, habitat, mode of nutrition, and physiology.
- The number of species that are known and described ranges between **1.7-1.8 million.**
- Even though there is such a variety and diversity among them, the living organisms show a lot of similarities and common features so that they can be arranged into many groups. In order to understand them and study them systematically, these living organisms, mainly the plants and animals are grouped under different categories.

TAXONOMY AND SYSTEMATICS

- **Taxonomy (Systematics)** is the branch of biology that deals with identification, nomenclature of living organisms and their classification on the basis of their similarities and differences.
- It was the Swiss-French botanist **Augustin-Pyramus de Candolle** (1778-1841) who coined the word Taxonomy, the science of naming and classifying of organisms.
- **Systematics** (Latin 'systema') means systematic placing of organisms into groups or taxa on the basis of certain relationships between organisms OR Study of principles and procedures of classification.
- It was **Carolus Linnaeus** who used this word first in his book '**Systema Naturae**'.
- The term **"New systematics"** was proposed by **Sir Julian Huxley** in 1940.

Processes of Taxonomy

- **Characterization:** It is the understanding of characters of organisms such as external and internal structure, structure of cell, development process, ecological information etc.
- **Identification:** Identification is the correct description of an organism and its recognition in its scientific name.
- **Classification:** It is the grouping of organisms into convenient categories (**taxa)** based on characters.
- **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.
- The system of naming with two components **(Binomial nomenclature)** is proposed by **Carolus Linnaeus.** According to binomial nomenclature, each scientific name has two components **- Generic name + Specific epithet**.
- Botanical names are based on the rules provided in **International Code for Botanical Nomenclature (ICBN).**
- Zoological names are based on **International Code for Zoological Nomenclature (ICZN).**

CLASSIFICATION

It is the process by which anything is grouped into conventional categories based on some easily observable characters.

Need for classification

- To organise the vast number of plants and animals into categories that could be named, remembered, studied and understood.
- Study of one organism of a group gives the idea about rest of the members of that group.
- Classification allows us to understand diversity better.

History of classification

- In the 3rd and 4th century BC **Aristotle** and others categorized organisms into plants and animals. They even identified a few thousand or more of living organisms.
- **Hippocrates** (460-377 BC), the Father of Medicine listed organisms with medicinal value.
- **Aristotle** and his student **Theophrastus** (370-282 BC) made the first attempt to classify organisms without stressing their medicinal value. They tried to classify the plants and animals on the basis of their form and habitat.
- It was followed by **Pliny the Elder** (23-79 AD) who introduced the first artificial system of classification in his book '**Historia Naturalis**'.
- **John Ray** an English naturalist introduced the term species for the first time for any kind of living things.
- It was then **Carolus Linnaeus** the Swedish naturalist of 18th century now known as Father of Taxonomy developed the **Binomial System of Nomenclature** which is the current scientific system of naming the species. In his famous book '**Species Plantarum'**(1753) he described 5,900 species of plants and in "**Systema Naturae'**(1758) he described 4,200 species of animals.

Advantages of classification

(i) Classification helps us identify the living organisms easily.
(ii) It makes study of such wide variety of bio life in systematic manner.

(iii) It helps us learning different plants and animals, similarities and dissimilarities among them.
(iv) It enables us understand how complex organisms evolve over the time.
(v) It helps us understand the inter-relationships among different groups.
(vi) It provides a systematic way to identify known and unknown organisms.
(vii) Classification systems are adapted internationally. This aid communication between scientists.

BINOMIAL NOMENCLATURE

Nomenclature is the process of giving scientific names to plants and animals. **Carolus Linnaeus** devised a binomial system of nomenclature in which an organism is given two names.

(i) A **generic name** which it shares with other closely related organisms which has features similar enough to place them in the same group.
(ii) A **specific name** which distinguished the organism from all other species. No other organism can have the same combination of genus and species.

The scientific name derived by using the system of nomenclature is followed all over the world as they are guided by a set of rules stated in the International Code of Nomenclature.

Universal Rules of Binomial Nomenclature

- Scientific names are generally in ***Latin*** and written in ***italics.***
- The first word is genus name **(Generic name)** and second word is the species name **(Specific epithet)**.
- When handwritten, the names are underlined.
- The names are printed in italics.
- The first name (Genus) starts with capital letter and the second name (Species) starts with small letter. E.g. ***Homo sapiens***. *Homo* represents the genus name and *sapiens* represents the species name.
- 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.

TAXONOMIC CATEGORIES

- Classification involves hierarchy of steps in which each step represents a **rank (taxonomic category or taxon).** All categories together constitute the **taxonomic hierarchy**.
- Each ***taxon*** represents a unit of classification.

Taxonomic hierarchy with example

Kingdom	-	**Animalia**
↑		
Phylum (**Division** in case of plants)	-	**Chordata**
↑		
Class	-	**Mammalia**
↑		
Order	-	**Primata**
↑		
Family	-	**Hominidae**
↑		
Genus	-	***Homo***
↑		
Species	-	***sapiens***

- **Species:** Species is the basis unit of classification. It is a group of individual organisms with fundamental similarities. It is defined as the group of individuals which resemble in their morphological and reproductive characters and interbreed among themselves and produce fertile offspring. This is the biological concept of species proposed by **Mayr**.
  Example: Crow. We have two types of crows. One is the common house crow found in plains around our houses. The other is the hill or the jungle crow. The two crows differ in the intensity of black colour on the neck, and in the size and shape of the beak.
  Both are crows but they cannot interbreed. Thus, they are different species.

Common Name	Generic Name	Specific Epithet
Mango	*Mangifera*	*indica*
Potato	*Solanum*	*tuberosum*
Nightshade	*Solanum*	*nigrum*
Lion	*Panthera*	*leo*
Peepal	*Ficus*	*religiosa*
Modern man	*Homo*	*sapiens*
Cat	*Felis*	*domesticus*
Tiger	*Felis*	*tigris*
Honey bee	*Apis*	*indica*
Housefly	*Musca*	*domestica*
Rubber plant	*Ficus*	*elastica*
House crow	*Corvus*	*splendens*

- **Genus:** It is the aggregates of closely related species. It consists of a group of related species which has more characters in common in comparison to species of other genera. Examples:
  ➢ Potato, tomato and brinjal are species of genus *Solanum.*
  ➢ Lion (*Panthera leo*), leopard (*P. pardus*) and tiger (*P. tigris*) are species of genus *Panthera.* This genus differs from another genus *Felis* which includes cats.
- **Family:** It is a group of related genera with less number of similarities as compared to genus and species.
  Examples:
  ➢ Family Solanaceae includes Genus *Solanum,* Genus *Petunia* and Genus *Datura.*
  ➢ Family Felidae includes Genus *Panthera* and Genus *Felis.*

- **Order:** It is the assemblage of related families.

  Examples:
  - ➢ Order Polymoniales includes Family Convolvulaceae and Family Solanaceae.
  - ➢ Order Carnivora includes Family Felidae and Canidae (dog).
- **Class:** It is the assemblage of related orders.

  Examples:
  - ➢ Order Primata, Carnivora etc. is placed in class Mammalia.
  - ➢ Order Polymonials and Order Sapindales etc. is placed in class Dicotyledonae.
- **Phylum (in animals) or Division (in plants):** It is the assemblage of related classes.

  Examples:
  - ➢ Classes Amphibia, Reptilia, Aves, Mammalia etc. come under phylum Chordata.
  - ➢ Class dicotyledonae and class monocotyledonae is place under division Angiospermae.
- **Kingdom:** The assemblage of various phyla. It is the highest category.

  Examples: Kingdom Plantae, Kingdom Animalia etc.

Organisms with their Taxonomic Categories

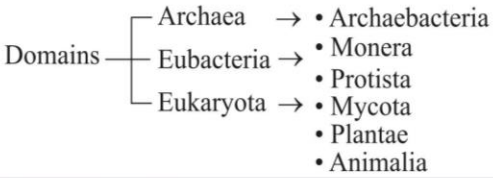
Common name	Man	Housefly	Mango	Wheat
Biological name	*Homo sapiens*	*Musca domestica*	*Mangifera indica*	*Triticum aestivum*
Genus	*Homo*	*Musca*	*Mangifera*	*Triticum*
Family	Hominidae	Muscidae	Anacardiaceae	Poaceae
Order	Primata	Diptera	Sapindales	Poales
Class	Mammalia	Insecta	Dicotyledonae	Monocotyledonae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

PHYLOGENY

- The evolutionary history of a particular taxon like species is called phylogeny.
- The classification based on the basis of evolution is called phylogenetic classification.
- Phylogenetic classification is not always possible since there are several gaps in the fossil records which form the basis of phylogenetic studies and also evolution is never unidirectional.
- Classification not explicitly based on evolutionary relationships is called artificial, for example, organisms are grouped according to usefulness (economic plants), size (herbs, shrubs), colour (flowers), ecological role (ground cover) and so-forth.

THREE DOMAINS OF LIFE

- All of life can be divided into three domains, which tell you the type of cell inside of an organism.
- The three domains are Archaea, Bacteria and Eukarya.
- It is proposed by **Carl Woese** in 1990 who also proposed the six kingdom classification for living organisms.



TAXONOMICAL AIDS

(a) Herbarium

- It is a store house (repository) of collected plant specimens that are dried, pressed and preserved on sheets and are arranged according to universally accepted classification.
- The herbarium sheets are labelled with information about date and place of collection, english, local and botanical names, family, collector's name etc.

(b) Botanical gardens

- These are specialized gardens having collections of living plants for reference and identification purposes.
- Each plant is labelled with its botanical name and family.
- **Famous botanical gardens are:**
  - ➢ Royal Botanical Garden, Kew (England).
  - ➢ Indian Botanical Garden, Howrah (India).
  - ➢ National Botanical Research Institute, Lucknow (India).

(c) Museum

- Museum is a collection of **preserved plants and animals** for study and reference.
- A museum contains specimens preserved in preservative solutions in containers or jars.
- Plant and animal specimens are preserved as dry specimens.
- Insects are preserved in insect boxes after collecting, killing and pinning.
- Stuffed larger animals like birds and mammals are also preserved.
- It also has collections of animal skeletons.

(d) Zoological Parks (Zoos)

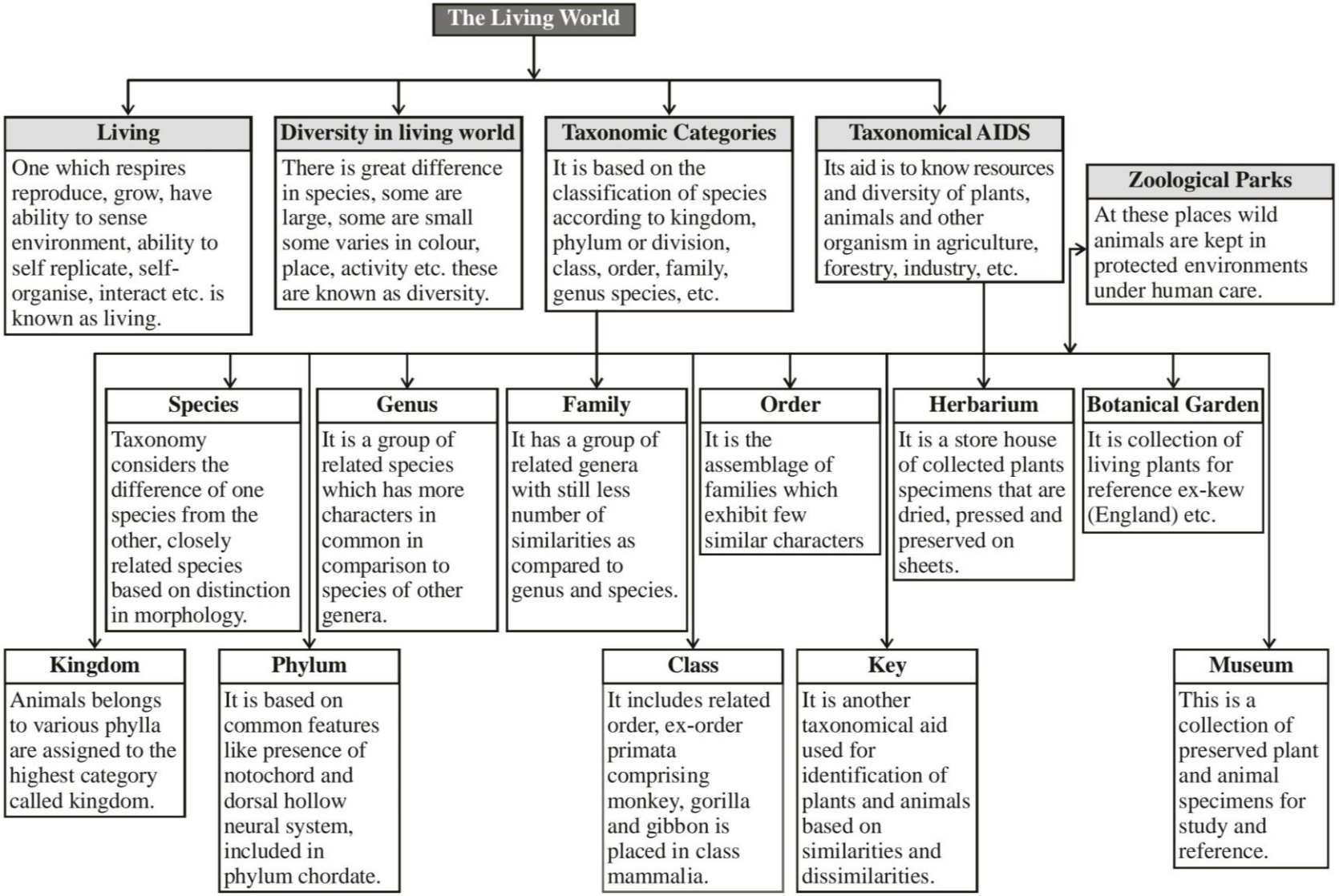
- These are the places where **live wild animals** are kept in protected environments under human care.
- It enables to learn about their food habits and behaviour.

(e) Key

- It is the device used to identify each species in a group of organisms based on similarities and dissimilarities.
- 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. Each statement in the key is called a **lead.**

FLORA, MANUALS, MONOGRAPHS AND CATALOGUES

- These are some other means of recording descriptions.
- They also help in correct identification.
- **Flora** contains the actual account of habitat and distribution of plant species of a given area.
- **Manuals** help in providing information for identification of names of species found in an area. They also provide information about keys, description of family, germs and species.
- **Monographs** contain comprehensive information on any one taxon at a given time.
- **Catalogues** provide information about new additions and update the seconds. The catalogues are also the means for recording information for taxonomy.



EXERCISE - 1
Conceptual Questions

1. Which is the most important but generally not used criteria for the identification of the species ?
(a) Interbreeding (b) Morphology
(c) Genetic material (d) None of these

2. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for
(a) interaction with the environment and progressive evolution
(b) reproduction
(c) growth and movement
(d) responsiveness to touch

3. Biological organisation starts with
(a) cellular level
(b) organism level
(c) atomic level
(d) sub-microscopic molecular level

4. The growth and reproduction are mutually exclusive events in
(a) Plants only
(b) Animals only
(c) Higher animals and plants
(d) Lower organisms

5. The sum total of chemical reactions occurring in our body is called
(a) Metabolism (b) Homeostasis
(c) Irritability (d) Catabolism

6. Mark the correct statement
(a) Only living organisms grow.
(b) Plants grow only up to a certain age.
(c) The growth in living organisms is from inside.
(d) All of these

7. Which of the following biological processes do not operate within the life span of a given organism ?
(a) Birth and nutrition
(b) Growth and maturation
(c) Metabolism and excretion
(d) Decomposition and mineralization

8. Growth development and functioning of living body is due to -
(a) Order (b) Homeostasis
(c) Metabolism (d) Adaptation

9. Which type of organisation is found in only living beings ?
(a) Atomic (b) Molecular
(c) Mixture (d) Sub-cellular

10. Organisation levels in living beings are -
(a) Subcellular → cellular → individual → community → population
(b) Atomic → molecular → subcellular → cellular → tissue → organ → individual
(c) Individual → population → organ system → tissue → cellular → molecular → atomic
(d) Atomic → molecular → tissue → individual → ecosystem → community.

11. Which of the following statement is false?
(a) Properties of cellular organelles are present in the molecular constituents of the organelles.
(b) Interactions among the molecular components of the organelles result into properties of cell organelles.
(c) Biology is the story of life on earth.
(d) Biology is the story of evolution of living organisms on earth.

12. A plant differs from an animal mainly in :
(a) Protoplasm (b) Vital activities
(c) Nutrition (d) Reproduction

13. Artificial system of classification classifies plants on the basis of –
(a) One or two characters
(b) Phylogenetic trends
(c) Many naturally existing characters
(d) None of the above

14. Group of organisms that closely resemble each other and freely interbreed in nature, constitute a–
(a) Species (b) Genus
(c) Family (d) Taxon

15. ICBN was first revised in –
(a) 1961 (b) 1964
(c) 1975 (d) 1753

16. The term taxon refers to –
(a) Name of a species
(b) Name of genus
(c) Name of family
(d) A taxonomic group of any rank

17. The herbarium specimen on whose basis a new species is described for the first time is called as –
(a) Syntype (b) Holotype
(c) Paratype (d) Neotype

18. The scientific naming of plants began with publication of Linnaeus book –
(a) Genera plantarum (b) Systema naturae
(c) Species plantarum (d) Charaka sanhita

19. The basic unit of classification is –
(a) Genus (b) Species
(c) Order (d) All of these

20. Individuals of same species having non-genetic differences due to environment are called –
(a) Biotypes (b) Ecotype
(c) Ecophenes (d) None of these

21. Morphologically similar but reproductively isolated species are called –
(a) Neontological species (b) Sibling species
(c) Allopatric species (d) Morpho-species

22. Plant nomenclature means :
(a) To give names to plants without any rules
(b) Nomenclature of plants under the international rules
(c) Nomenclature of plants in local language
(d) Nomenclature of plants in english language

23. Taxonomy refers to –
(a) Plant classification (b) Plant nomenclature
(c) Plant affinity (d) All of these

24. Which of the following is a correct name ?
(a) *Solanum tuberosum*
(b) *Solanum Tuberosum*
(c) *Solanum tuberosum* Linn.
(d) All of these

25. Systematics deals with –
(a) Classification (b) Nomenclature
(c) Plant description (d) Plant exploration

26. Phylogeny refers to –
(a) Natural classification
(b) Evolutionary classification
(c) Evolutionary history
(d) Origin of algae

27. Static concept of species is given by –
(a) Linnaeus (b) Bentham
(c) Koch (d) Mayr

28. In taxonomy the first step is :
(a) Identification (b) Nomenclature
(c) Classification (d) Affinities

29. The suffix - inae signifies the rank :
(a) Tribe (b) Sub tribe
(c) Sub order (d) Sub family

30. Species living in different geographical areas are called –
(a) Allochronic (b) Allopatric
(c) Sympatric (d) Siblings

31. Biological concept of species proposed by –
(a) Linnaeus (b) Mayr
(c) John Ray (d) De Candolle

32. For higher plants, flowers are chiefly used as a basis of classification, because –
(a) These show a great variety in colour
(b) It can be preserved easily
(c) Reproductive parts are more conservative than vegetative parts
(d) None of these

33. The smallest unit of classification is –
(a) Family (b) Order
(c) Genus (d) Species

34. A division is formed by combining several –
(a) Orders (b) Families
(c) Classes (d) Tribes

35. What characters are used for declaration of new species of higher plants ?
(a) Floral character of new species
(b) Anatomical characters of new species
(c) Physiological charactes of new species
(d) Character of endosperm

36. Evolutionary classification is called –
(a) Artificial system (b) Natural system
(c) Phylogenetic system (d) None of the above

37. Which of the following statements regarding nomenclature is correct ?
(a) Generic name always begins with capital letter whereas specific name with small letter
(b) Scientific name should be printed in italics
(c) Scientific name when typed or handwritten should be underlined
(d) All the above

38. The biological concept of species is mainly based on –
(a) Morphological features
(b) Morphology and method of reproduction
(c) Method of reproduction only
(d) Reproductive isolation

39. Which system classifies a plant in more than one groups ?
(a) Practical classification
(b) Artificial classification
(c) Natural classification
(d) Phylogenetic classification

40. The term "New Systematics" was introduced by
(a) Bentham and Hooker (b) Linnaeus
(c) Julian Huxley (d) A.P. de Candolle

41. Classification given by Bentham and Hooker is
(a) Artificial (b) Natural
(c) Phylogenetic (d) Numerical

42. Artificial system of classification was first used by
(a) Linnaeus (b) De Candolle
(c) Pliny the Edler (d) Bentham and Hooker

43. System of classification used by Linnaeus was
(a) Natural system (b) Artificial system
(c) Phylogenetic system (d) Asexual system

44. An important criterion for modern day classification is
(a) Resemblances in morphology
(b) Anatomical and physiological traits
(c) Breeding habits
(d) Presence or absence of notochord

45. Binomial nomenclature means
(a) One name given by two scientists
(b) One scientific name consisting of a generic and specific epithet
(c) Two names, one latinised, other of a person
(d) Two names of same plant

46. Phylogenetic classification is based on
(a) Utilitarian system
(b) Habits
(c) Overall similarities
(d) Common evolutionary descent

47. Which of the following is less general in characters as compared to genus?
(a) Species (b) Division
(c) Class (d) Family

48. The practical purpose of classification of living organisms is to
(a) explain the origin of living organsims
(b) trace the evolution of living organsims
(c) name the living organisms
(d) facilitate identification of unknown organisms

49. The five-kingdom classification was suggested by
(a) Eichler (b) Whittaker
(c) Engler and Prantl (d) Bentham & Hooker

50. The disadvantage of using common names for species is that:
(a) the names may change
(b) one name does not apply universally
(c) one species may have several common names and one common name may be applied to two species
(d) All of the above

51. An organism is in the same class but not in the same family. It may belong to same
(a) Genus (b) Species
(c) Variety (d) Order

52. The order generally ends with :
(a) Ales (b) Aceae
(c) Eae (d) None of these

53. Practical significance of taxonomy is –
(a) Classification
(b) To understand diversity
(c) To understand evolution
(d) Identification of organisms

54. Taxonomic hierarchy refers to
(a) Step-wise arrangement of all categories for classification of plants and animals
(b) A group of senior taxonomists who decide the nomenclature of plants and animals
(c) A list of botanists or zoologists who have worked on taxonomy of a species or group
(d) Classification of a species based on fossil record

55. The 'Birds' taxonomically represent
(a) Family (b) Order
(c) Class (d) Phylum

56. Karyotaxonomy is a modern branch of classification which is based on:
(a) organic evolution
(b) number of nuclei
(c) number of chromosomes
(d) trinomial nomenclature

57. Who is known as 'Father of Taxonomy' :
(a) Huxley (b) Linnaeus
(c) Theophrastus (d) None of these

58. The systematic arrangement of taxa is called –
(a) Key (b) Taxonomy
(c) Geneology (d) Hierarchy

59. The taxonomic status of an organism can be changed by changing
(a) anatomy (b) physiology
(c) morphology (d) genetic make up

60. The standard size of herbarium sheets is –
(a) 11.5" × 16.5" (b) 15.5" × 16.5"
(c) 18.5" × 10.5" (d) 20.5" × 21.5"

61. Herbarium is –
(a) A garden where medicinal plants are grown
(b) Garden where herbaceous plants are grown
(c) Dry garden
(d) Chemical to kill plants

62. Sequence of taxonomic categories is
(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

63. "Taxonomy without phylogeny is similar to bones without flesh" is the statement of
(a) Oswald Tippo (b) John Hutchinson
(c) Takhtajan (d) Bentham and Hooker

64. The famous botanical garden 'Kew' is located in
(a) England (b) Lucknow
(c) Berlin (d) Australia

65. The Indian Botanical garden is located in
(a) Howrah (b) Lucknow
(c) Mumbai (d) Mysore

66. Following taxonomic aid provides information for the identification of names of species found in an area
(a) Monograph (b) Manual
(c) Flora (d) Periodical

67. Who developed the 'key' for identification of animals?
(a) John Ray (b) Goethe
(c) Theophrastus (d) George Cuvier

68. An important function of botanical garden is -
(a) Providing beautiful area for recreation
(b) One can observe tropical plants over there
(c) They allow ex-situ conservation of germ plasm
(d) They provide natural habitat to wildlife

69. ICBN stands for
(a) International Code of Botanical Nomenclature
(b) International Congress of Biological Names
(c) Indian Code of Botanical Nomenclature
(d) Indian Congress of Biological Names.

70. As we go from species to kingdom in a taxonomic hierachy, the number of common characteristics
(a) will decrease.
(b) will increase.
(c) remain same.
(d) may increase or decrease.

71. Which one of the following aspects is an exclusive characteristic of living things ?
(a) Isolated metabolic reactions occur in vitro
(b) Increase in mass from inside only
(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.

72. The most important feature of all living systems is to
(a) utilize oxygen to generate energy
(b) replicate the genetic information
(c) produce gametes
(d) utilize solar energy for metabolic activities

73. First life on earth was
(a) Cyanobacteria
(b) Chemoheterotrophs
(c) Autotrophs
(d) Phototrophs

74. What is true for individuals of same species?
(a) Live in same niche (b) Live in same habitat
(c) Interbreeding (d) Live in different habitat

75. Organisms which obtain energy by the oxidation of reduced inorganic compounds are called
(a) photoautotrophs (b) chemoautotrophs
(c) saprozoic (d) coproheterotrophs

EXERCISE - 2
Applied Questions

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

2. Select the correct statement from the following?
(a) Fitness is the end result of the ability to adapt and gets selected by nature
(b) All mammals except whales and camels have seven cervical vertebrae
(c) Mutations are random and directional
(d) Darwinian variations are small and direction less.

3. Which one of the following animals is correctly matched with its particular named taxonomic category ?
(a) Tiger - *tigris*, the species
(b) Cuttle fish - mollusca, a class
(c) Humans - primata, the family
(d) Housefly - musca, an order

4. Which one of the following organisms is scientifically correctly named, correctly printed according to the International Rules of Nomenclature and correctly described?
(a) *Musca domestica* - The common house lizard, a reptile.
(b) *Plasmodium falciparum* – A protozoan pathogen causing the most serious type of malaria.
(c) *Felis tigris* - The Indian tiger, well protected in Gir forests.
(d) *E.coli* - Full name *Entamoeba coli, a* commonly occurring bacterium in human intestine.

5. Which of the following is less general in characters as compared to genus?
(a) Species (b) Division
(c) Class (d) Family

6. What is true for photolithotrops?
(a) Obtain energy from radiations and hydrogen from organic compounds
(b) Obtain energy from radiations and hydrogen from inorganic compounds
(c) Obtain energy from organic compounds
(d) Obtain energy from inorganic compounds

7. In five kingdom system, the main basis of classification is
(a) structure of nucleus (b) mode of nutrition
(c) structure of cell wall (d) asexual reproduction

8. Species are considered as
(a) real units of classification devised by taxonomists
(b) real basic units of classification
(c) the lowest units of classification
(d) artificial concept of human mind which cannot be defined in absolute terms

9. Angiosperms have dominated the land flora primarily because of their
(a) power of adaptability in diverse habitat
(b) property of producing large number of seeds
(c) nature of self pollination
(d) domestication by man

10. Which one of the following is not a correct statement ?
(a) Botanical gardens have collection of living plants for reference.
(b) A museum has collection of photographs of plants and animals
(c) Key is taxonomic aid for identification of specimens.
(d) Herbarium houses dried, pressed and preserved plant specimens.

11. The common characteristics between tomato and potato will be maximum at the level of their
(a) genus (b) family
(c) order (d) division

12. 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 decreases

13. Which of the following pairs of organisms reforoduce by budding?
(a) Yeast and *Hydra* (b) Yeast and *Amoeba*
(c) *Hydra* and *Amoeba* (d) *Planaria* and *Hydra*

14. Category, class, includes related
(a) orders (b) speries
(c) genus (d) family

15. Which of the following statements correct about herbarium?
(a) It is a store house of collected plant specimens that are dried and preserved on sheets
(b) Herbarium sheets contain information about date and place of collection, names, family, collector's name etc.
(c) It serves as quick referral systems in taxonomical studies
(d) All of the these

16. In biological taxonomy, a _____is a comprehensive treatment of a taxon
(a) flora (b) manuals
(c) monograph (d) monogram

17. Phenetic classification is based on
(a) sexual characteristics
(b) the ancestral lineage of existing organisms
(c) observable characteristics of existing organisms
(d) dendograms based on DNA characteristics

18. Biosystematics aims at
(a) identification and arrangement of organisms on the basis of their cytological characteristics
(b) the classification of organisms based on broad morphological characters
(c) delimiting various taxa of organisms 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

19. Match column I (Biological name) with column-II (Class), and choose that correct option given below the column.

Column-I (Biological name)	**Column-II (class)**
(A) *Homo Sapiens*	(1) Dicotyledonae
(B) *Musca domestica*	(2) Mammalia
(C) *Mangifera indica*	(3) Monocotyledonae
(D) *Triticum aestivum*	(4) Insecta

(a) A→4; B→2; C→1; D→3
(b) A→2; B→4; C→3; D→1
(c) A→2; B→4; C→1; D→3
(d) A→2; B→1; C→4; D→3

20. Match the following and choose the correct option:

Column-I	**Column-II**
(A) Family	(1) *tuberosum*
(B) Kingdom	(2) Polymoniales
(C) Order	(3) *Solanum*
(D) Species	(4) Plantae
(E) Genus	(5) Solanaceae

(a) A→4; B→3; C→5; D→2; E→1
(b) A→5; B→4; C→2; D→1; E→3
(c) A→4; B→5; C→2; D→1; E→3
(d) A→5; B→3; C→2; D→5; E→4

21. Which two points are known as the twin characteristics of growth?
(1) Increase in mass
(2) Differentiation
(3) Increase in number of individuals
(4) Response to stimuli
(a) (1) and (2) (b) (1) and (4)
(c) (2) and (3) (d) (1) and (3)

22. Choose the correct one
(1) Growth cannot be taken as a defining property of living organism.
(2) Dead organism does not grow.
(3) Reproduction cannot be an all inclusive defining characteristic of living organisms.
(4) No nonliving object is capable of replicating itself.
(5) Metabolism in a test tube is nonliving.
(6) Metabolism is a defining feature of all living organisms.
(a) (1) and (3) (b) All except (5)
(c) All except (3) (d) All of these

DIRECTIONS for Qs. 23 to 24: Each questions contain STATEMENT-1 (Assertion) and STATEMENT-2 (Reason). Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

(a) Statement- 1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement -1
(b) Statement -1 is True, Statement -2 is True ; Statement-2 is NOT a correct explanation for Statement - 1
(c) Statement - 1 is True, Statement- 2 is False
(d) Both the Statements are False.

23. **Statement 1 :** Botany deals with the study of plants and zoology deals with the study of animals.
Statement 2 : Biology is the study of living beings.

24. **Statement 1 :** Formation of new species is called speciation.
Statement 2 : The deme has a common gene pool.

25. **Statement 1 :** Systematics is the branch of biology that deals with classification of living organisms.
Statement 2 : The aim of classification is to group the organisms.

EXERCISE - 3
Exemplar & Past Years NEET/AIPMT Questions

Exemplar Questions

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 study of organ systems
(b) identification and preservation of plants and animals
(c) diversity of kinds of organisms and their relationship
(d) study of habitats 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 the above

5. The taxonomic unit 'Phylum' in the classification of animals is equivalent to which hierarchial level in classfication 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) and (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 organisation
(d) All of the 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

10. Match the following and choose the correct option.

Column I	Column II
A. Family	1. *Tuberosum*
B. Kingdom	2. Polymoniales
C. Order	3. *Solanum*
D. Species	4. Plantae
E. Genus	5. Solanaceae

Options

	A	B	C	D	E
(a)	4	3	5	2	1
(b)	5	4	2	1	3
(c)	4	5	2	1	3
(d)	5	3	2	1	4

NEET/AIPMT (2013-2017) Questions

11. Which one of the following is not a correct statement ? ***[2013]***
(a) Botanical gardens have collection of living plants for reference.
(b) A museum has collection of photographs of plants and animals
(c) Key is taxonomic aid for identification of specimens.
(d) Herbarium houses dried, pressed and preserved plant specimens.

12. The common characteristics between tomato and potato will be maximum at the level of their ***[NEET Kar. 2013]***
(a) Genus (b) Family
(c) Order (d) Division

13. Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature? ***[2016]***
(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

14. It is much easier for a small animal to run uphill than for a large animal, because ***[2016]***
(a) it is easier to carry a small body weight.
(b) smaller animals have a higher metabolic rate.
(c) small animals have a lower O_2 requirement.
(d) the efficiency of muscles in large animals is less than in the small animals.

Hints & Solutions

EXERCISE - 1

1. (a)
2. (b) There are several factors and processes which differentiate living beings with non-living beings like reproduction, respiration, growth, etc. But among them reproduction is the only difference which differentiate without any exception living beings with non-living things.
3. (d) Biological organisms starts with sub-microscopic moleculer level like viruses, bacteria etc. These organisms are unable to be seen by naked eyes without the help of microscope or even electron microscope.

4. (c) 5. (a) 6. (c) 7. (d) 8. (c) 9. (d)
10. (b) 11. (a) 12. (c) 13. (a) 14. (a) 15. (c)
16. (d) 17. (b) 18. (c)
19. (b) The basic unit of classifications is species.
20. (c) 21. (b) 22. (b) 23. (d) 24. (c) 25. (c)
26. (c) Phylogeny refers to evolutionary history.
27. (a) 28. (a) 29. (b) 30. (b) 31. (b) 32. (c)
33. (d) The smallest unit of classification is species.
34. (c) 35. (a) 36. (c) 37. (d) 38. (d) 39. (a)

40. (c) The term "New Systematics" was given by Julian Huxley (1940). Characters of plants collected through different branches of science are considered *e.g.* ecology, physiology, biochemistry, cytology, genetics, etc.
41. (b) George Bentham and Joseph Dalton Hooker has given Natural system of classification.
42. (c) Pliny the Edler introduced first artificial system of classification in his book *Historia Naturalis*.
43. (b) Linnaeus put forward an "Artificial system" of plant classification which was based on sexual characters. It is commonly also called as sexual system of plant classification.
44. (b) Modern day classification is new systematics or biosystematics which includes all the characteristics of organisms gathered from the study of different sections like physiology, ecology, anatomy, biochemistry, cytology.
45. (b) Binomial Nomenclature means the scientific name of any organism consist of a generic epithet and a specific epithet.
46. (d) The first phylogenetic system of classification was proposed by Adolf Engler and his associate Karl Prantl in their monograph "*Die Naturlichen Pflanzen Familien*". In this system of classification organisms are classified on the basis of evolutionary sequence and genetic relationship among the organisms. Hence, this system is highly dynamic not static.
47. (a) Species is the lowest taxonomic category. Class is a category made of one or more related orders possessing similar correlated characters, Family is composed of one to many related genera. Division comprises of several related classes.
48. (d) Biological classification is the scientific arrangement of organisms in a hierarchial series of groups and subgroups on the basis of similarities and differences in their traits. It helps in building evolutionary pathways and in identifying new organisms.
49. (b) On the basis of complexity of cell structure, mode of nutrition, complexity of the body organisms – R.H. Whittaker (1969) gave five kingdom of classification. The five kingdoms are– Monera, Protista, Fungi, Plantae and Animalia.

50. (d) 51. (d) 52. (a) 53. (d) 54. (a) 55. (c)
56. (c) 57. (b) 58. (d) 59. (d)
60. (a) The standard size of herbarium sheets is 11.5" × 16.5".
61. (c) Herbarium is dry garden.
62. (c) 63. (c) 64. (a) 65. (a) 66. (b) 67. (a)
68. (c)
69. (a) ICBN (International Code of Botanical Nomenclature) - It is one of the code of nomenclature which is independent of zoological and bacteriological nomenclature. The code applies equally to names of taxonomic groups treated as plants whether or not these groups were originally so treated.
70. (a) All the members of a taxonomic category possess some similar characters which are different from those of others. The placement of individuals or organisms in species, genus, family, order, class and phylum are determined by their specific similar characters and relationships. Maximum similarity occurs in species which is also the lowest category in the hierarchy of categories. Similarity of characters decreases with the ascent in hierarchy.
71. (c) All living things have an ability to respond to their environment, that is also called stimulation.
72. (b) Replication of the genetic information causes transfer of genetic information from one generation to the next.
73. (b)
74. (c) Individuals of the same species can interbreed. No two individuals share the same ecological niche.
75. (b) The organisms obtaining energy by chemical reactions independent of light are called chemotrophs. When the

reductants obtained from the environment in inorganic form then organisms are chemoautotrophs. While when its is organic then organisms are chemoheterotrophs.

Photoautotroph make their food by photosynthesis using the energy of sun.

Saprozoic organisms obtain food from dead and decaying matter.

EXERCISE - 2

1. (b) Gene flow is the spread of genes through populations as effected by movements of individual and their propagules, *e.g.* seeds spores etc. Gene flow ensures that all populations of a given species share a common gene pool. *i.e.* it reduces difference between populations. The interruption of gene flow between populations is a pre-requisite for the formation of new species.
2. (a) To survive in a particular environment, an organism need to adapt in that environment. If the organism becomes success in adapting them that organism is selected by nature.
3. (a) Tiger and tigris both are from same genus with particular taxonomic category.
4. (c)
5. (a) Species is the lowest taxonomic category. Class is a category made of one or more related orders possessing similar correlated characters, Family is composed of one to many related genera. Division comprises of several related classes.
6. (b)
7. (b) The five kingdom classification is a mode of classification based on the following criteria.
   - Complexity of cell structure
   - Complexity of body structure
   - Modes of nutrition
   - Ecological life styles
   - Phylogenetic relationship
8. (c)
9. (a) Angiosperms have adapted themselves to all kinds of habitat - terrestial, aquatic, tropical, deciduous and alpine. Self pollination is seen in very few angiosperms. Production of large number of seeds ensure that at least some will germinate. Not all plants have been domesticated by man.
10. (b) Museums have collections of preserved plant and animal specimens for study and reference.
11. (b) Families are characterised on the basis of both vegetative and reproductive features of plant species. Tomato *(Lycopersicon esculentum)* and potato *(Solanum tuberosum)* belong to the same family Solanaceae.
12. (a) 13. (a) 14. (a) 15. (d) 16. (c)
17. (c) Phenetic classification is based upon observable characteristics of an organism.
18. (d) Biosystematics is the study of diversity of organism and all their comparative and evolutionary relationships.
19. (c) 20. (b) 21. (d) 22. (b)
23. (a) Biology (Bio-living, logy-science). The study of living beings is called biology. Living beings on earth are mainly classified into two forms-plants and animals. Botany and zoology are the fundamental branches of biology. Word botany has been derived from greek word *botane* which means pasture or plants and zoology has been derived from word zoo-animals, logos-study. Theophrastus and Aristotle is called the father of botany and father of zoology respectively.
24. (b) All new species develop from the pre-existing species. The phenomenon of development of a new species from pre-existing one is called speciation. A species is a collections of demes. The deme is a groups of populations with a common gene pool.
25. (b) Systematics is related with classification of organisms. In classification the organisms are grouped on the basis of their characters or phylogeny, etc.

EXERCISE - 3

Exemplar Questions

1. (a) Lower the taxa, more are the number of shared characteristics within the members of the taxon. So, the lowest taxon shares the maximum number of morphological similarities. As we move towards the higher hierarchy, *i.e.*, class, kingdom, similarities decrease.
2. (c) The names of family, taxon in plants always end with suffix aceae, e.g., Solanaceae, Cannaceae and Poaceae. Suffix **ales** is used for taxon '**order**' while suffix **ae** is used for '**class**' and suffixes **onae** are not used in any of the taxons.
3. (c) The word systematics has been derived from the Latin word 'Systema' meaning systematic arrangement of organisms. Linnaeus used 'Systema Naturae' as a title of his publication. It describes the diversity of organisms and their relationship at every level of organisation.
4. (c) **Genus** comprises of a group of closely related species with more characters in common as compared to species of other genera.
5. (c) Division is inclusive of classes with few similar characters of a group of organism. It is equivalent to 'Phylum' used in case of animals.
6. (c) **Botanical gardens** and **Zoological parks** are used to restore depleted population, reintroduce species and restore degraded habitats of both exotic and endemic living species.
7. (c) **Taxonomic keys** are tools that help in identifying of an organism based on the characters. It includes both monograph and flora.

8. (b) All living organisms possess a common genetic material, DNA, but with variations, *e.g.*, DNA in bacteria is circular while in highly evolved eukaryotic cells as plants and animals, DNA is a long double stranded helix.

9. (d) Besides growth and reproduction response to an external stimuli or to the environment in which an organism dwells is the most important characteristic of any living organism.

Howevers, virus (which is not included under living organisms) also show growth and reproduction. Thus, these options are not true.

10. (b) The correct options matching with the columns represent the taxonomic classification of the plant potato :

Family	-	Solanaceae
Kingdom	-	Plantae
Order	-	Polymoniales
Genus	-	*Solanum*
Species	-	*tuberosum*

NEET/AIPMT (2013-2017) Questions

11. (b) **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 collections, killing and pinning. Larger animals like birds and mammals are usually stuffed and preserved. Museums often have collections of skeletons of animals too.

12. (b) Families are characterised on the basis of both vegetative and reproductive features of plant species. Tomato *(Lycopersicon esculentum)* and potato *(Solanum tuberosum)* belong to the same family Solanaceae.

13. (a) Binomial 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.

14. (b) Basal metabolic rate is inversely proportional to body size. So smaller animals have a higher metabolic rate. Hence production of energy is more.