

Solution

BIOLOGICAL CLASSIFICATION WS 1

Class 11 - Biology

Section A

1. **(a)** Aristotle
Explanation: Over 2000 years ago, a Greek scientist named Aristotle was one of the first people to classify living things. He noticed that living things fit into two main groups: green and did move. Aristotle next divided all animals into three groups. He based his groups on where the animals lived.
2. **(c)** Slime molds
Explanation: Slime molds were earlier kept under kingdom fungi but due to multinucleate character and naked protoplasm, they are now considered as belonging to monera.
3. **(c)** Five kingdom classification
Explanation: Organisms are divided into five major kingdoms. R.H Whittaker proposed the five-kingdom classification in 1969. The most common system of classification in use today is the Five Kingdom Classification. In this system, all living organisms are divided into five kingdoms.
4. **(a)** Monera
Explanation: All prokaryotic, unicellular organisms are included in the kingdom Monera. The Eukaryotic unicellular organisms are placed in the Protista kingdom.
5. **(d)** Algae
Explanation: Algae grouped together the unicellular organisms and the multicellular ones.
6. **(c)** Cyanobacteria
Explanation: Blue-green algae are also called cyanobacteria. They are considered as the most primitive organism that still survives. It includes different forms of unicellular and multicellular organisms.
7. **(a)** Whittaker
Explanation: Five kingdom classification was proposed by R.H. Whittaker in 1969. The kingdoms identified by him were Monera, Protista, Fungi, Plantae and Animalia.
8. **(d)** Viral Domain
Explanation: Three kingdoms or domain system of classification does not include the viral domain. The virus was discovered after the invention of the electron microscope so, they were not part of the living world.
9. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Earlier classification systems included bacteria, blue-green algae, fungi, mosses, ferns, gymnosperms, and the angiosperms under 'Plants' as all the organisms had a cell wall in their cells. It brought together the prokaryotic bacteria and the blue-green algae with other groups that were eukaryotic. It also grouped together with the unicellular organisms and the multicellular organisms, for example, Chlamydomonas and Spirogyra were placed together under algae.
10. Under Monera group all prokaryotes were kept in five kingdom system.
11. In the five-kingdom system of Whittaker, four kingdoms are eukaryotes which are as follows:
 - i. Protista
 - ii. Fungi
 - iii. Plantae
 - iv. Animalia
12. Linnaeus proposed the two kingdom classification in 1758.
13. Classification of organisms into plants and animals was easily done and was easy to understand.
14. Eukaryota.

15. Many species of cyanobacteria can carry out nitrogen fixation in soil. Hence, they are used in agricultural fields for crop improvement.
16. Saprophytic.
17. Kingdom Monera
18. These organisms get plenty of nutrients in polluted water. Hence, they often bloom in such conditions and are found in abundance in polluted water.

Section B

19. The three-domain system is a biological classification introduced by Carl Woese et al. in 1977 that divides cellular life forms into archaea, bacteria, and eukaryote domains.
20.
 - Nucleus is not well defined in prokaryotes, which means that genetic materials are not enclosed in a capsule. Prokaryotes include two groups: bacteria and another group called archaea.
 - Nucleus is well defined in eukaryotes, which means that genetic materials are enclosed in a capsule. Eukaryotes can be single-celled or multi-celled, such as plants, fungi, and insects.
21.
 - Cell wall is present in bacteria, while cell wall is absent in protozoa.
 - Protozoa is a sub group of Kingdom: Protista, which comes under the Eukaryotes domain, whereas bacteria could be described as an entire taxonomical domain.
 - Number of identified bacteria species is lower than that of protozoa. However, the actual number of bacteria species is vastly greater than the number of protozoa species.
 - Bacteria are prokaryotes while protozoans are eukaryotes.
 - Incidence of bacteria on Earth is greatly higher than protozoa.
 - Bacteria are extremophiles but not protozoans.
 - The body sizes of protozoans are usually higher than the bacteria.
22. The main criteria used for five kingdom system of classification are:
 - i. The Complexity of cell structure.
 - ii. The Complexity of the organism's body.
 - iii. Mode of obtaining nutrition.
 - iv. Life cycle and phylogenetic relationship.
23. The common name 'pea' is an English word and this can have different names in different languages. It is easier to remember a standard scientific name as compared to so many names. Hence, instead of using simple common names; it is preferred to use scientific names that may appear complicated but universally accepted.
24. (a) Curdling of milk.
 (b) Lactobacillus is an important commensally in the gut flora of humans.
 (c) Penicillin antibiotics are prepared by bacteria.
 (d) Bacteria is a good decomposer, so it assists in completing the energy cycle.
 (e) Rhizobium bacteria helps in nitrogen fixation.

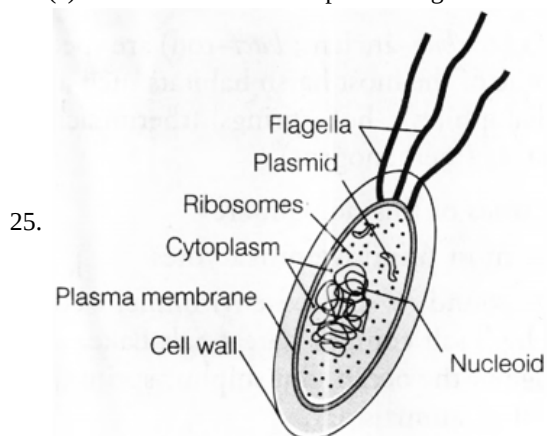


Figure: A bacterial cell

26. Mesosomes help in invagination of the membranes. Large septal mesosomes occur near centre of the cell and smaller lateral mesosomes away from the centre. Septal mesosomes help in cell division and lateral mesosomes assist in the reproduction of bacterial DNA chromosome.
27. Methanogens are a type of bacteria which live in the gut of ruminating animals. They assist those animals in digestion and the byproduct of that digestive process is methane.

More number of livestock population results in increased methane level in the environment leading to global warming. So, indirectly methanogens can be responsible for global warming.

28. Cyanobacteria evolved more than three million years back. They are the self-contained photosynthetic organisms. They can, therefore, live under any type of environment and on any of substrate. Because of this, they are one of the earliest colonisers of barren areas.

Section C

29.	Monera	Protista
	The cell wall is made up of peptidoglycan.	The cell wall is made up of peptidoglycan.
	Respiratory apparatus is present in the respiratory membrane.	It is present in mitochondria.
	Ribosomes are 70S type.	Ribosomes are 80S type.
	These are prokaryotic and have naked circular DNA.	Eukaryotic, linear DNA is present in the nucleus.
	Extrachromosomal DNA is present in the form of plasmids.	Extrachromosomal DNA is present in organelles like mitochondria and chloroplast.

30. Although the two are vastly different from each other. They still bear some common characters, on the basis of which they are introduced in Eubacteria of kingdom-Monera.

These characters are as follows

- i. Both the groups do not possess a well-defined nucleus.
- ii. Nucleus lacks nucleolus and nuclear membrane.
- iii. DNA (genetic material) lies freely in the cytoplasm.
- iv. They possess 70 S type of ribosomes.

31. The two Kingdom systems of classification are inadequate due to new developments and information about the organisms.

Some of the inadequacies of these systems are:

- i. It is difficult to identify and distinguish the lower animals or plants because a few of them have common characters. Example - Euglena, a single-celled organism, possesses a mixture of animal and plant characteristics. It has chlorophyll but it is a heterotroph also.
- ii. Bacteria are microscopic organisms having a cell wall. They have prokaryotic cellular organisation lacking a nuclear membrane. They seem to be plants rather than animals because some of them are able to synthesize food.
- iii. The position of slime moulds, Chlamydomonas, sponges, lichens and diatoms is not clear in this system.

32. Aristotle was the first to use scientific basis for classification. He used morphological characters to differentiate plants and animals.

Further, Aristotle classified plants into trees, shrubs and herbs. He classified animals based on presence or absence of the red blood.

Later Linnaeus proposed two kingdoms, viz. plant kingdom and animal kingdom. This system became very popular because of its simplicity and was used for a long time by scientists. But as the knowledge about finer characteristics of living being increased, scientists started to find that there were some organisms which couldn't fit either of the kingdoms.

A need was being felt to include more number of characteristics like mode of reproduction, evolutionary relationship etc. to facilitate better categorization. Thus the latest 'Five Kingdom Classification' evolved. Five kingdoms are as follows:

- (1) Monera
- (2) Protista
- (3) Fungi
- (4) Plantae
- (5) Animalia

33. The earlier system of classification was based on **external, morphological, observable characters** with the help of naked eyes.

Aristotle considered only **limited features** in the classification of the organism. At that time the diverse living organisms were put in a limited number of groups. **Species Plantarum** had a description of 4000 species of plants and they were classified on the basis of sexual characters.

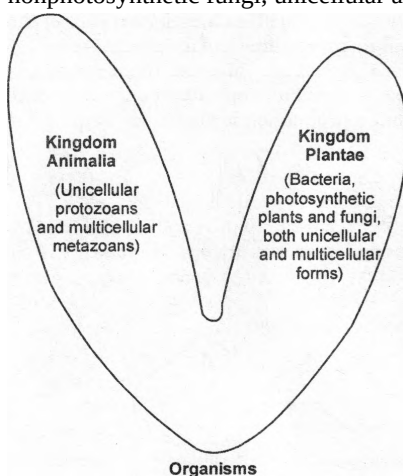
34. Phylogeny is the evolutionary history of an organism. It shows the true kinship of the organism. Such relationships are not clear in all cases. The only fossil record can provide such relationships, but complete records are not available for such studies. Hence, the

phylogenetic relationships are ascertained from morphology, cytology, genetics, physiology, and biochemistry for the correct classification of the organisms.

35. Two kingdom classification was unable to accommodate certain living beings as they neither had properties of animals nor of plants. Through two kingdom classification it was not possible to include every set of characters in a particular kingdom. Five kingdom classification could accommodate more set of characters. As a result it was easier to categorize all living beings. For example bacteria can be autotrophic as well as heterotrophic. It was a difficult question to categorize them either under plant or animal. A separate kingdom was the most logical choice. Similarly viruses are a borderline case between living and non-living. When they don't get host then they behave like a non-living. Once, inside a host they spring to life. Although the five kingdom classification does not have room for virus but it opened the way for a better and more inclusive system of classification.
36. Three domains system or six-kingdom classification is a biological classification system in which living organisms were divided based on cellular characteristics. Carl Woese in 1990 introduced it. The three domains are
- i. **Archaea**- It contains prokaryotic organisms, which have a mono layer core of lipids in the cell membrane and distinct nucleotides in their 16 S RNA.
 - ii. **Bacteria**- It contains typical prokaryotes, which lack membrane covered cell organelles but do not have a type of microchambers for separating various activities.
 - iii. **Eukarya**- This domain contains eukaryotic organisms, originated by the endosymbiotic association between some archaeobacteria and eubacteria. It have four kingdoms-Protista, Fungi, Plantae and Animalia.

37.	Artificial system	Natural system
	Based on one or two morphological characters.	Employs a large number of characters.
	Gives no information about natural relationships or phylogeny.	Imparts phylogenetic relationship of the organisms.
	Depicts little information about the groups.	Provides detailed information about the groups.
	No homology studied.	Homology of all the characters is considered.
	Based on superficial characters like habitat.	Uses characters from various fields of biology like anatomy.
	May put similar organisms in different groups.	Brings similar organisms in the same group.

38. The two kingdom classification system was given by Linnaeus in 1758. Lesser number of organisms were known then in comparison to what the world knows today. He classified all the known living beings into two categories-Animalia and Plantae on the basis of the presence or absence of cell wall in their cells. As bacteria, blue-green algae, fungi, algae, mosses, ferns, gymnosperms, and angiosperms have their cells surrounded by cell walls, unlike animals, therefore, they were placed together under kingdom-Plantae.
39. **Two-kingdom system of classification:** In the two-kingdom system of classification, all organisms were kept in either one of two large kingdoms. **Plant kingdom** and **animal kingdom**. Animal kingdom includes **unicellular protozoans** and **multicellular metazoans**. The plant kingdom includes all other organisms—prokaryotes (bacteria) and eukaryotes, photosynthetic plants and nonphotosynthetic fungi, unicellular and multicellular forms.

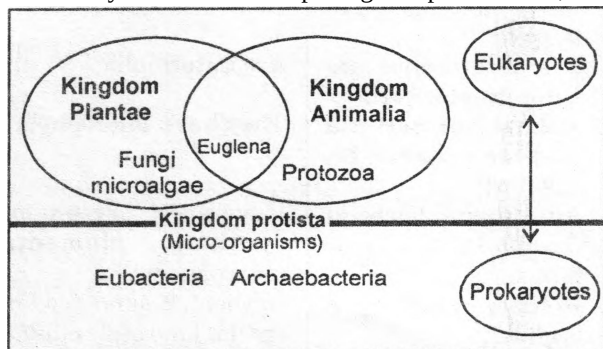


40. The three kingdom classification system was proposed by Ernst Haeckel in 1866. He did not distinguish bacteria from other living beings. They were incorrectly placed under kingdom-Protista. This shortcoming was removed by **Copeland** in 1956 when he placed all the bacteria and related organisms into another kingdom-Monera. Copeland's system of classification was able to separate prokaryotic organisms from eukaryotic organisms which were a major drawback of Haeckel's system of classification.

41. **Need for classification:** Classification becomes essential for the following reasons:

- i. It is very essential for the systematic study of living beings. Without this, the study of different organisms would be in confusion.
- ii. It is impossible to study each and every organism.
- iii. All the types of organisms do not occur in a given locality.
- iv. Without a proper system so classification is impossible to recognize or identify different types of organisms.
- v. Classification helps in knowing the relationships among different groups of animals and plants.

42. **Three-kingdom system of classification:** Kingdom Protista includes those organisms that can be differentiated from plants and animals by their lack of morphological specialisation, most of them being unicellular



43. There are millions of species on this planet. The largest phylum Arthropoda alone comprises of millions of species. To study all of them properly we need some system for categorizing them, based on some common characteristics.

Apart from that think of the differences in language and you will find different names for the same species in different languages. In the absence of a system of nomenclature it would have been difficult to share scientific knowledge among the scientists of different nations.

To make things easier and systematic the need for classifications was felt. Earlier attempts by people like Aristotle segregated living beings into plants and animals. This was good point to start with, but there are certain living beings which do not fit in either of plants or animals.

So a three kingdom classification was devised. The three kingdom classification was used for some time. But as none of the scientific theory is permanent so further discoveries led to creation of a five kingdom classification. The five kingdom classification is the most accepted system of classification.

44.	Pili	Fimbriae
	They are tube-like outgrowths of bacterial cells.	They are solid outgrowths of bacterial cells.
	Their length is about 18-20 μm .	Their length is about 0.15-1.5 μm .
	Only 1-4 pili occur per cell.	About 300-400 fimbriae occur per cell
	They help in conjugation.	They help in clinging to various objects.

45. a. Economically important use of heterotrophic bacteria:

- i. Preparation of curd
- ii. Production of antibiotics

b. Economically important use of archaeobacteria:

- i. Methanogens are type of archaeobacteria and are present in the gut of ruminating animals. They are responsible for production of methane from ruminating animals dung.
- ii. Archaeobacteria can live in the most harsh environments, like sulphur springs, volcano etc. They are important as they give us clue how life may have started when the earth was too hot or too cold.

46. **Characteristics of the Kingdom Monera:**

It includes all prokaryotic organisms such as archaeobacteria, eubacteria, mycoplasma, cyanobacteria, etc. The monerans lack a true nucleus, nuclear membrane, nucleolus, chromatin, histone proteins, and all membrane-bound organelles. The genetic material is known as nucleoid or (genophore = incipient nucleus chromosome). It is made of naked DNA, RNA and proteins. The ribosomal RNA are of a 70S type. The cell wall is made up of peptidoglycan (except in Archaeobacteria and Mycoplasma). They reproduce asexually by means of binary fission. Respiratory enzymes are found associated with the plasma membrane. The cell division is amitotic type and spindle formation does not take place.

47. Important characteristics of bacteria are

- i. Bacteria are found in all kinds of habitats.
 - ii. They are prokaryotic microorganisms.
 - iii. They are unicellular.
 - iv. Cell wall contains peptidoglycan.
 - v. An organised nucleus is absent.
 - vi. Extrachromosomal self-replicating DNA segments called **plasmids** occur in most of the bacteria.
 - vii. Mitochondria, plastids, Golgi apparatus, endoplasmic reticulum, and other membrane-bound cell organelles are absent.
48. i. **Heterocysts** are present in some cyanobacteria. It is a large-sized, pale coloured, thick-walled cell which occurs in the terminal, intercalary or lateral position in filamentous cyanobacteria, e.g., Nostoc.
- ii. Features of cyanobacteria are
- a. Mucilage sheath is present.
 - b. Thylakoids lack phycobilins. Therefore, photosynthesis is absent, but cyclic photophosphorylation occurs.
 - c. Heterocyst is dependent for its nourishment on adjacent vegetative cells. The thick wall is impermeable to oxygen but permeable to nitrogen. It has enzyme nitrogenase which is specialised to perform nitrogen-fixation.

49.

Bacteria	Algae
Most are heterotrophic, some are autotrophic	All are heterotrophic
Prokaryotic	Eukaryotic
Cell wall present	Cell wall present
Unicellular	Multicellular

50. They are typically prokaryotic have a single chromosome and no membrane-bound organelles. They are cosmopolitan in distribution (occur in air, water, soil, plant plus animal body) size range 0.1 to 1.5 µm in diameter, 2-10 µm in length, on the basis of shape they may be coccus, bacillus, and vibrio (spiral), flagella may be present; cell wall made of murein, bacteria may be Gram -ve or Gram +ve; blue-green algae are photosynthetic autotrophs; some bacteria are heterotrophs.

51.

Autotrophic Bacteria	Heterotrophic Bacteria
The bacteria synthesize their own food.	The bacteria obtain organic food or organic growth factors from outside sources.
They depend on external sources of energy for the synthesis of food.	An external source of energy is not required.
Autotrophic bacteria live on the inorganic substrate.	Heterotrophic bacteria live on organic substratum or living host.

Section D

52. All organisms are multicellular, eukaryotes with heterotrophic mode of nutrition.

53.

Prokaryotic cell	Eukaryotic cell
Genetic material is not enclosed in a nuclear envelope and is present suspended in the cytoplasm in a region called nucleoid.	Genetic material is enclosed within the nucleus by a nuclear envelope and is not present in direct contact with cytoplasm.
Cell wall is made up of peptidoglycan.	Cell wall is made up of chitin in fungi and cellulose in plants.
Nucleolus is absent.	Nucleolus is present.

54. Linnaeus used artificial system kingdom of classification.

Drawbacks of Linnaeus two kingdom classification:

- o Linnaeus developed a Two Kingdom system of classification with Plantae and Animalia kingdoms.
 - o This system did not distinguish between eukaryotes and prokaryotes, unicellular and multicellular organisms, photosynthetic (green algae) and non-photosynthetic (fungi) organisms.
55. No, Fungi-Autotrophic (Photosynthetic) and Heterotrophic is not correct match. The walls of the fungi were made of chitin, whereas the green plants had a cellulose cell wall.
56. The advantages of five-kingdom classification over two-kingdom classification are as follows:
- o It is based on cell structure
 - o It is based on the body structure

- Nutrition
- Way of living
- Phylogenetic relationship

57. Protista

Characteristic of protists:

- Most of them live in water while some inhabit moist places.
- They have a membrane-bound nucleus and other cellular organelles

58. Heterotrophs are those organisms that cannot prepare their own food and depend on other organisms (plants and animals) for food. Yes, Euglena is heterotrophic and also possess chlorophyll like plants to synthesize their food.

59. R. H. Whittaker proposed the five-kingdom classification.

R.H. Whittaker's primary classification criteria include cell structure, body organization, mode of nutrition, reproduction, and phylogenetic relationships.

Section E

60. **(d)** Haeckel

Explanation: Haeckel

61. **(d)** Protista

Explanation: Protista

62. **(b)** Euglena

Explanation: Euglena is heterotrophic and also possess chlorophyll like plants to synthesize their food.

63. **(b)** R. H. Whittaker

Explanation: R. H. Whittaker

64. **(b)** Both A and R are true but R is not the correct explanation of A.

Explanation: The five kingdom classification is based on prokaryotic & eukaryotic cell; unicellular and multicellular organization; mode of nutrition; body organization and so on.

65. Two kingdom system of classification was proposed by **Carolus Linnaeus** (1758). **Linnaeus** proposed two kingdoms in the living world:

- Kingdom Animalia** for animals and
- Kingdom Plantae** for plants.

The two-kingdom system for classification is **inadequate** since the new development information about the organisms. Some of the problems are:

- It is difficult to identify and distinguish the lower animals or plants because a few of them have common characters.

Example: Euglena a single-celled organism, possesses a mixture of animal and plant characteristics. It has chlorophyll but it is a heterotroph also.

- Bacteria:** They are microscopic organisms having a cell wall. They have prokaryotic cellular organisation lacking a nuclear membrane. They seem to be plants rather than animals because some of them are able to synthesize food.

66. Merits of five kingdom classification system are:

- Euglena and other transition types which had been included both amongst plants and animals are given proper place under kingdom-Protista.
- Fungi have their own biochemical, physiological and structural organisation. They have never been related to plants. In this system of classification, fungi are separately placed.
- A separate kingdom-**Monera** including prokaryotes has been created. Monerans differ from all other organisms in their cellular, reproductive and physiological organisations.
- The five-kingdom classification system is based on cellular organisation, the mode of nutrition and complexity of structure. These were the basic factors used in the earliest two-kingdom system of classification.
- The system shows the gradual evolution of early organisms into plants and animals.
- The plant and animal kingdoms are more homogenous than they were in the two-kingdom system of classification.

67. Biological classification keeps changing with our understanding of life forms. Initially, new characters were taken by Aristotle, Theophrastus, John Ray and Linnaeus. Linnaeus divided plants on the basis of sex organs only. As more and more knowledge gathered for delimitation of taxa, the ways for the natural system of classification became clear. This can be understood by the following examples

- i. Two kingdom classification was replaced by three kingdom classification when Haeckel (1866) proposed the kingdom of Protista.
 - ii. It was converted into four-kingdom classification by Copeland when he proposed the kingdom-Monera.
 - iii. Whittaker in 1969 proposed five kingdom classification.
 - iv. As the information about the biochemistry of archaebacteria gathered, Carl Woese in 1990 raised another kingdom, Archaea.
68. i. The interior of the bacterial cell seems simple and granular because the membrane-bound organelles are not present in it.
- ii. Mucilage, cell wall, and plasma membrane are together called the cell envelope.
 - iii. Mucilage or glycocalyx gives gummy or sticky trait to cells. Though it is not essential for bacterial survival, glycocalyx has several functions such as
 - a. Protection from desiccation and toxins.
 - b. Preventing host phagocytes to get attached to the bacterium.
 - c. Holding cells together.
 - d. Storing chemicals for virulence.
69. A bacterial cell consists of the following components:
- i. **Cell envelope:** It is the outer covering of protoplasm of the bacterial cell. It contains mucilage sheath, cell wall, and plasma membrane.
 - ii. **Cytoplasm:** It is a crystal colloidal complex that forms the protoplasm excluding its nucleoid. Membrane-bound cell organelles are absent. Cytoplasm along with nucleoid are together called as protoplasm.
 - iii. **Nucleoid:** It represents the genetic material of prokaryotes. Nucleoid consists of a single circular strand of DNA duplex which is supercoiled with the help of RNA. No nuclear envelope is present.
 - iv. **Plasmids:** These are self-replicating, extrachromosomal segments of double-stranded, circular, naked DNA.
 - v. **Flagella:** These are unstranded, equivalent to a single microtubular fibre. These help in movement and locomotion.
 - vi. **Pili and fimbriae:** Pili are longer, fewer and thicker tubular outgrowths made up of protein pilin. Fimbriae are small bristle-like fibres sprouting from the cell surface in large number. Pili are helpful in attaching to a recipient cell and forming conjugation tube. Fimbriae cause agglutination of RBC. They also help in mutual clinging of bacteria.

Section F

70. **(d)** Blue-green algae
Explanation: Blue-green algae
71. **(a)** A-Body organisation, B-Eukaryotic, C-Present
Explanation: A-Body organisation, B-Eukaryotic, C-Present
72. **(d)** Artificial system
Explanation: Artificial system
73. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: Both A and R are true but R is not the correct explanation of A.
74. **(c)** Fungi- Autotrophic (Photosynthetic) and Heterotrophic
Explanation: Fungi- Autotrophic (Photosynthetic) and Heterotrophic
75. **(b)** IV and II
Explanation: IV and II