CHAPTER › 02

Biological Classification

NEET KEY NOTES

- **Biological classification** refers to the scientific procedure in which living organisms are classified and arranged into groups and sub-groups in a hierarchial manner on the basis of their similarities and dissimilarities.
- **Aristotle** was the earliest to attempt a scientific basis for classification. Later **Linnaeus** gave the **two kingdom system** of classification with **Plantae** and **Animalia** kingdoms.
- This system though used till very recently, but was unable to distinguish between the eukaryotes and prokaryotes, unicellular and multicellular organisms and photosynthetic (plants) and non-photosynthetic organisms (fungi).
- In 1969, **RH Whittaker** proposed a **five kingdom system of classification**. He divided all living organisms into **Monera, Protista, Fungi, Plantae** and **Animalia** as summarised in table below.

Characters	Kingdom–Monera	Kingdom–Protista	Kingdom–Fungi	Kingdom–Plantae	Kingdom–Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Complexity of body	Unicellular to multicellular	Unicellular	Unicellular to multicellular	Multicellular	Multicellular
Cell wall	Non-cellulosic and peptidoglycan	Present or Absent	Chitinous	Cellulosic	Absent
Nutrition	Autotrophic or Heterotrophic	Autotrophic or Heterotrophic	Heterotrophic (saprophytic/parasitic)	Autotrophic (photosynthetic)	Heterotrophic (holozoic or parasitic)

- Earlier classification systems considered bacteria, BGA (Blue-Green Algae), fungi, mosses, ferns, gymnosperms and angiosperms as plants due to the presence of cell wall in them. This classification system placed prokaryotic bacteria and BGA with other eukaryotic groups.
- It also grouped unicellular and multicellular, organisms together, e.g. *Chlamydomonas* and *Spirogyra* (in algae).
- This system did not consider the differences in mode of nutrition and cell wall composition, so grouped fungi (heterotroph, chitinous cell wall) with plants (autotroph, cellulosic cell wall).
- Five kingdom classification considered such characteristics and segregated prokaryotic organism under **Monera**, unicellular eukaryotes in **Protista** (this united *Chlamydomonas* and *Chlorella* with *Paramecium* and *Amoeba* earlier placed in plants and animals, respectively).

Kingdom–Monera

- Bacteria are the sole members of this kingdom.
- Bacteria are the most abundant microorganisms occurring in air, water, soil as well as in extreme habitats like deserts, snow, hot springs, etc.
- Bacteria have been grouped under four categories based on their shape
  - *Coccus* (cocci) – Spherical
  - *Bacillus* (bacilli) – Rod-shaped
  - *Vibrium* (vibrio) – Comma-shaped
  - *Spirillum* (spirilla) – Spiral-shaped.
- Bacteria show a wide range of mode of nutrition. They may be autotrophic (synthesise their own food from inorganic substrates), chemotrophic (photosynthetic autotrophic), saprophytic or heterotrophic (depend on other organisms for food).
- Bacteria are further divided into **Archaebacteria** and **Eubacteria**.

Archaebacteria

- Archaebacteria live in extreme environmental conditions. These include
  - **Halophiles** Bacteria residing in salty areas.
  - **Thermoacidophiles** Bacteria residing in hot springs.
  - **Methanogens** Bacteria which survive in marshy areas (these are present in gut of many ruminant animals like cows and buffaloes).
- Archaebacteria differ from other bacteria in having different cell wall structure. Their cell wall is made up of **murein** and contains high amount of unsaturated fatty acids, which is responsible for ensuring their survival in extreme conditions.

Eubacteria

- Another class–Eubacteria is also known as 'true bacteria'.
- These have rigid cell wall made up of peptidoglycan.
- They could be photosynthetic autotrophs, chemosynthetic, autotrophs and heterotrophic bacteria.
- **Photosynthetic autotrophs** include blue-green algae, which have chlorophyll-*a* similar to green plants. Also known as **cyanobacteria**.
- These could be unicellular, colonial or filamentous, freshwater/marine or terrestrial algae.
- Some bacteria can fix atmospheric nitrogen in specialised cells known as **heterocyst**, e.g. in *Nostoc* and *Anabaena*.
- Some bacteria utilise inorganic substances like nitrate, nitrite, ammonia, etc., for oxidation and release of energy for ATP production. These are known as **chemosynthetic autotrophic bacteria**.
- **Heterotrophic bacteria** (most abundant in nature) are dependent on other organisms for nutrition. These include N_2-fixing bacteria, pathogens, etc.
- These reproduce asexually by **binary fission.**
- During unfavourable conditions, these form spores.
- These also show conjugation, a type of sexual reproduction in which DNA is transferred from one bacteria to another through a conjugal tube.
- Pleomorphic bacteria, which lack cell wall is known as **mycoplasma**. They are pathogenic and the smallest microorganism known.

Kingdom–Protista

- All single-celled eukaryotes are placed under **Protista**.
- Members of kingdom–**Protista** are the connecting link between prokaryotic monerans and complex multicellular kingdoms–**Fungi**, **Plantae** and **Animalia**.
- These include chrysophytes, dinoflagellates, euglenoids, slime moulds and protozoans.
- These show a well-defined nucleus and membrane bound organelles.
- They reproduce asexually and sexually by a process involving cell fusion and zygote formation.
- Kingdom–Protista has been further divided into the following groups
- **Chrysophytes** include **diatoms** and **golden algae** known as **desmids**. They are found in marine environment.
  - The cell wall of diatoms is embedded with silica and forms two thin overlapping sheath as in soap box.
  - **Diatomaceous earth** is the large amount of cell wall deposits of diatoms in their habitat. These are used in polishing, filtration of oils and syrups.
- **Dinoflagellates** are marine and photosynthetic microorganisms.
  - Due to the presence of different pigments, they appear yellow, green, brown and red.
  - As the name suggest they have two flagella one lies longitudinally and other transversely in furrow between wall plates.
  - *Gonyaulax* is a red dinoflagellate, which undergoes rapid multiplication and forms red tides. Toxins released by these microorganisms when present in such large numbers may even kill other marine animals such as fishes.
- **Euglenoids** are freshwater organism found in stagnant water.
  - Cell wall is absent, a protein rich layer called pellicle is present over the surface.
  - In the presence of sunlight, they behave as autotrophs, while in its absence they behave as heterotrophs, e.g. *Euglena*.
- **Slime moulds** are saprophyte, which are dependent on dead and decaying organic matter.
  - They form an aggregation called **plasmodium.**
  - During unfavourable conditions, they form spores, which are highly resistant.

- **Protozoans** are heterotrophs and live as parasites or predators. These are grouped into
  - **Amoeboid protozoans** found in fresh or marine water or moist soil. They have pseudopodia (false feet) to capture prey as in *Amoeba*.
  - **Flagellated protozoans** either free-living or parasitic having flagella. The parasitic forms cause diseases, e.g. sleeping sickness by *Trypanosoma.*
  - **Ciliated protozoans** are aquatic, actively moving organisms due to thousands of cilia present on them. The coordinated ciliary movement drives food into cavity called **gullet**, e.g. *Paramecium*.
  - **Sporozoans** are non-motile forms with an infectious spore like stage in their life cycle, e.g. malaria causing parasite *Plasmodium.*

Kingdom–Fungi

- These are heterotrophic organisms with their cell wall made up of chitin.
- These have cosmopolitan distribution and are found in warm and humid places.
- Fungal body consists of long, thread-like structures called **hyphae**, which together form a network called **mycelium**. In certain organisms, hyphae are continuous tube with multinucleated cytoplasm (**coenocytic**), while others have septae or cross walls.
- Their mode of nutrition is **saprophytic** and **parasitic**. They can also live as **symbionts** in association with algae as lichen and with roots of higher plants as **mycorrhiza**.
- Reproduction in fungi occurring by vegetative means, includes fragmentation, fission and budding, asexually by zoospore production conidia, etc., and sexually by oospores, ascospores and basidiospores.
- Sexual cycle involves **plasmogamy** (fusion of two protoplasts), **karyogamy** (fusion of two haploid nuclei) and **meiosis**.
- In some fungi, two haploid cells result in diploid cells. In some cases, **dikaryon** stage occurs in which two nuclei are present within a cell. This phase is known as **dikaryophase** of fungus.
- Production of dikaryon ($n + n$, i.e. two nuclei per cell) is a characteristic of the classes–**Ascomycetes** and **Basidiomycetes**.
- Fungi are classified into classes–Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes.
  - **Phycomycetes** are lower fungi or algal fungi, their mycelium is aseptate and coenocytic, reproduce asexually through zoospores or aplanospores and sexually through isogamy or anisogamy, e.g. *Rhizopus, Mucor*, etc.
  - **Ascomycetes** are sac fungi, their mycelium is branched and septate, asexual spores are conidia and sexual spores are ascospores, e.g. *Aspergillus, Neurospora,* etc.
  - **Basidiomycetes** are club fungi, their mycelium is branched and septate, reproduce asexually by fragmentation and their vegetative cells fuse to form dikaryotic structure (plasmogamy), e.g. mushrooms, bracket fungi, etc.
  - **Deuteromycetes** are imperfect fungi, reproduce asexually by conidia and sexual forms absent in these e.g. *Alternaria, Trichoderma,* etc.
- **Heterothallism** is the condition in fungal organisms where different thalli exist within a single genus of fungus.

Kingdom–Plantae

- These include chlorophyllous organisms with cellulosic cell wall.
- Life cycle consists of a dominant sporophyte and a highly reduced gametophyte showing **alternation of generations.**
- Few members are insectivorous plants, e.g. *Cuscuta*, bladderwort, etc.
- Plants are classified into algae, bryophytes, pteridophytes, gymnosperms and angiosperms.

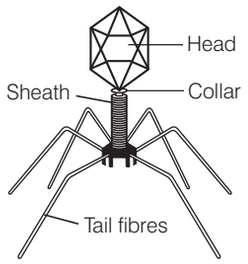
Kingdom–Animalia

- Animals are motile organisms showing holozoic nutrition. They follow a definite growth pattern.
- They directly or indirectly depend on plants for food.
- Sexual reproduction is by copulation of male and female gametes followed by embryo development.

Viruses, Viroids, Prions and Lichens

- **Viruses** and **viroids** are the non-cellular organisms, which are not characterised in the system of classification given by **Whittaker**.
- They have both living and non-living characteristics.
- They form inert crystalline structure outside the living cell, but inside the host cell they can multiply easily.
- They take over the host machinery and replicate themselves.
- **Pasteur** and **DJ Ivanowsky** gave the name virus, which means venom or poisonous fluid.
- **MW Beijerinck** in 1898, called fluid obtained from infected tobacco plant as *Contagium vivum fluidum* (infectious living fluid).
- Viruses are obligate parasite. These are inert outside specific host cell and exist in crystalline form as demonstrated by **WM Stanley**.
- Genetic material of viruses could be DNA or RNA.

- Virus contain a protein coat called **capsid**, which is made up of **capsomeres**. Capsomeres are arranged in a helical or polyhedral geometric form.



Bacteriophage virus

- Viruses which infect plants have *ss*RNA, while which infect animals are either *ss*DNA/RNA or *ds*DNA/RNA.
- Viruses which infect bacteria are known as **bacteriophage**. These are usually *ds*DNA viruses.
- **Viroids**, discovered by **TO Diener** are the smallest known agents of infectious disease. These are only naked nucleic acid without a protein coat.
- **Prions** are abnormally folded proteins with cause infectious neurological diseases, e.g. mad cow disease in cattle.
- **Lichens** are the symbiotic association of algae (phycobiont) and fungi (mycobiont). They are also not included in five kingdom system.

Mastering NCERT

MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Introduction and Kingdom–Monera*

1 Aristotle classified the plants on the basis of their morphological characters and categorised them into
(a) trees, shrubs and herbs
(b) algae, bryophytes, pteridophytes, gymnosperms and angiosperms
(c) embryophytes and tracheophytes
(d) algae and embryophytes

2 Who proposed two kingdom system of classification and named kingdoms as Plantae and Animalia?
(a) Carolus Linnaeus (b) RH Whittaker
(c) Carl Woese (d) Herbert Copeland

3 Which of the following characters served as the criteria for five kingdom system of classification proposed by Whittaker?
(a) Cell structure
(b) Body organisation and mode of nutrition
(c) Reproduction and phylogenetic relationships
(d) All of the above

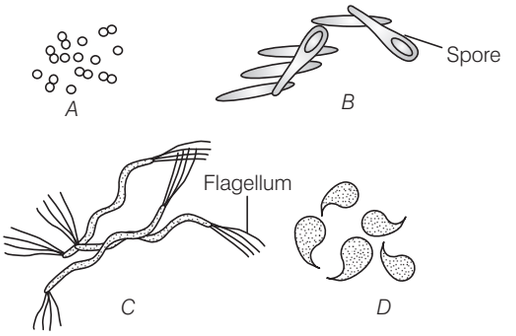
4 In five kingdom system of classification of RH Whittaker, how many kingdoms contain eukaryotes?
(a) Four kingdoms
(b) One kingdom
(c) Two kingdoms
(d) Three kingdoms

5 In the five kingdom classification, *Chlamydomonas* and *Chlorella* are included in
(a) Plantae (b) Algae
(c) Protista (d) Monera

6. Cyanobacteria are classified under which of the following kingdom?
(a) Protista (b) Monera
(c) Algae (d) Plantae

7 Among the following, which one is the most abundant group of microorganisms?
(a) Algae (b) Viruses
(c) Protists (d) Bacteria

8 Bacteria are grouped under four categories based on their shape. Refer to the given figure. Identify *A*, *B*, *C* and *D*.



(a) A–Vibrio, B–Cocci, C–Bacilli, D–Spirilla
(b) A–Cocci, B–Bacilli, C–Spirilla, D–Vibrio
(c) A–Bacilli, B–Spirilla, C–Vibrio, D–Cocci
(d) A–Spirilla, B–Vibrio, C–Cocci, D–Bacilli

9 Some bacteria thrive in extreme environmental conditions such as the absence of oxygen, high salt concentration, high temperature and acidic pH. Identify the type of bacteria.
(a) Cyanobacteria (b) Eubacteria
(c) Archaebacteria (d) Mycobacteria

10 Which of the following conditions would be favoured by thermoacidophiles?
(a) Hot and alkaline (b) Snow and acidic
(c) Hot and sulphur spring (d) Gut of cows

11 Which of the following are found in extreme saline conditions? ***NEET 2017***
(a) Archaebacteria (b) Eubacteria
(c) Cyanobacteria (d) Mycobacteria

12 The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the ***NEET 2016***
(a) thermoacidophiles (b) methanogens
(c) eubacteria (d) halophiles

13 Methanogens belong to ***NEET 2016***
(a) eubacteria (b) archaebacteria
(c) dinoflagellates (d) slime moulds

14 *Thermococcus, Methanococcus* and *Methanobacterium* are
(a) archaebacteria having eukaryotic histone homologue
(b) bacteria with cytoskeleton
(c) archaebacteria with negatively supercoiled DNA as eukaryotes, but lack histones
(d) bacteria having positively coiled DNA, cytoskeleton, mitochondria

15 Eubacteria include
(a) blue-green algae and bacteria
(b) archaebacteria and blue-green algae
(c) cyanobacteria and eukaryotes
(d) bacteria and eukaryotes

16 Pigment containing membranous extensions in some cyanobacteria are ***CBSE-AIPMT 2012***
(a) heterocysts (b) basal bodies
(c) pneumatophores (d) chromatophores

17 The cyanobacteria are also referred to as ***CBSE-AIPMT 2012***
(a) protists (b) golden algae
(c) slime moulds (d) blue-green algae

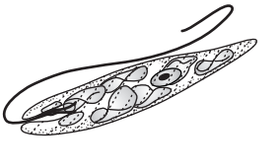
18 In cyanobacteria, which of the following is present?
(a) Chlorophyll-*c* (b) Chlorophyll-*b*
(c) Chlorophyll-*a* (d) Chlorophyll-c_1

19 …… include blue-green algae, which have chlorophyll-*a* similar to green plants.
Complete the given sentence with an appropriate option.
(a) Chemosynthetic autotrophic bacteria
(b) Photosynthetic autotrophic bacteria
(c) Protista
(d) Saprophytic

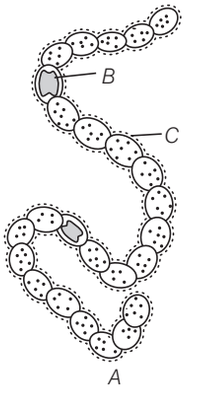
20 Specialised cells called heterocysts are present in
(a) dinoflagellates
(b) chrysophytes
(c) archaebacteria
(d) cyanobacteria

21 Some of the cyanobacteria can fix atmospheric nitrogen in their specialised cells called
(a) akinetes (b) heterocyst
(c) endospores (d) homocyst

22 Identify the diagram of heterocyst. ***JIPMER 2019***

(a) 
(b) 
(c) 
(d) 

23 Given figure is of a filamentous blue-green algae. Identify the algae and choose the option that is correct for *A*, *B* and *C* in the figure.

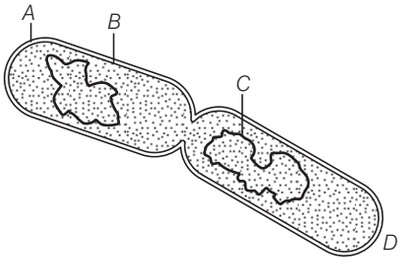


(a) A–*Gelidium*, B–Vegetative cell, C–Heterocyst
(b) A–*Volvox*, B–Somatic cell, C–Mucilaginous sheath
(c) A–*Chara*, B–Mucilaginous sheath, C–Heterocyst
(d) A–*Nostoc*, B–Heterocyst, C–Mucilaginous sheath

24 *Nostoc* and *Anabaena* belong to
(a) parasitic bacteria (b) archaebacteria
(c) cyanobacteria (d) coccibacteria

25 Which of the following is photoautotrophic bacteria?
(a) *Nostoc* (b) *Clostridium*
(c) *Salmonella* (d) *Escherichia coli*

26 Identify the label *A, B, C* and *D* in the following figure.



(a) A–Plasma membrane, B–Cell wall, C–RNA, D–Spore formation
(b) A–Cell wall, B–Cell membrane, C–DNA, D–Binary fission
(c) A–Mucilaginous sheath, B–Cell membrane, C–RNA, D–Conjugation
(d) A–Plasma membrane, B–Mucilaginous sheath, C–DNA, D–Transformation

27 Which of the following bacteria play an important role in the recycling of nutrients like nitrogen, phosphorus, iron and sulphur?
(a) Chemoheterotrophic bacteria
(b) Chemosynthetic autotrophic bacteria
(c) Parasitic bacteria
(d) Saprophytic bacteria

28 Oxygen is not produced during photosynthesis by ***NEET 2018***
(a) *Cycas* (b) *Nostoc*
(c) Green sulphur bacteria (d) *Chara*

29 Citrus canker is a
(a) viral disease (b) bacterial disease
(c) fungal disease (d) protozoan disease

30 Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen? ***NEET 2017***
(a) *Bacillus* (b) *Pseudomonas*
(c) Mycoplasma (d) *Nostoc*

31 Mycoplasma are classified under which of the following kingdoms?
(a) Animalia (b) Protista
(c) Monera (d) Fungi

TOPIC 2~ *Kingdom–Protista*

32 Which of the following is not a feature of Protista?
(a) Protists are prokaryotic
(b) Some protists have cell walls
(c) Mode of nutrition is both autotrophic and heterotrophic
(d) Body organisation is cellular

33 Which of the following kingdoms have no well-defined boundaries?
(a) Plantae (b) Protista
(c) Monera (d) Algae

34 Members of Protista are primarily
(a) terrestrial (b) aquatic
(c) pathogenic (d) photosynthetic

35 Chrysophytes, euglenoids, dinoflagellates and slime moulds are included in the kingdom ***NEET 2016***
(a) Protista (b) Fungi
(c) Animalia (d) Monera

36 Which of the following groups of organisms is/are placed under the group–Chrysophyta?
(a) Diatoms only
(b) Desmids only
(c) Diatoms and golden algae
(d) Desmids and *Paramecium*

37 Diatoms and desmids are found in
(a) freshwater (b) marine water
(c) Both (a) and (b) (d) terrestrial habitat

38 Chrysophytes are
(a) planktons
(b) nektons
(c) benthic organisms
(d) active organisms

39 Silica gel is obtained by
(a) red algae
(b) diatoms
(c) *Euglena*
(d) mycoplasma

40 In which of the following organisms the cell wall is composed of two thin overlapping shells, which fit together like a soap-case?
(a) Diatoms (b) Golden algae
(c) Slime moulds (d) *Gonyaulax*

41 Diatomaceous earth is used for all except
(a) filtration of oils
(b) filtration of syrups
(c) cleaning agent in metal polishes
(d) gobar gas production

42 Which one of the following is a characteristic feature of the group–Chrysophyta?

(a) They are parasitic forms, which cause diseases in animals
(b) They have a protein rich layer called pellicle
(c) They have indestructible wall layer deposited with silica
(d) They are commonly called dinoflagellates

43 Which of the following organisms are known as chief producers in the oceans? ***NEET 2018***

(a) Cyanobacteria (b) Diatoms
(c) Dinoflagellates (d) Euglenoids

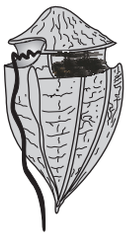
44 Dinoflagellates have

(a) two flagella, which lie longitudinally
(b) only one flagellum in the transverse groove between the cell plates
(c) only one flagellum in the longitudinal groove between the cell plates
(d) one flagellum lies longitudinally and the other transversely in a furrow between the wall plates

45 In which of the following groups, the cell wall has stiff cellulose plate on the outer surface?

(a) Diatoms (b) Red algae
(c) Dinoflagellates (d) Slime moulds

46 Refer to diagram given along side and select the incorrect option regarding it.



(a) It belongs to kingdom–Protista and is a dinoflagellate
(b) It is mostly marine, photosynthetic with colour depending on main pigment present in its cells
(c) They have two flagella, a short and a long one
(d) These organisms release toxins in large number which kill other marine animals

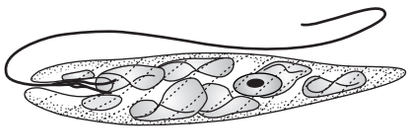
47 Red tides in warm coastal water develop due to the presence of

(a) dinoflagellates (b) euglenoid forms
(c) diatoms and desmids (d) slime moulds

48 Which of the following protists releases toxins that may even kill fishes and other marine animals?

(a) *Euglena* (b) *Gonyaulax*
(c) *Paramecium* (d) *Plasmodium*

49 Which group of organisms is represented by the given figure?



(a) Dinoflagellates (b) Protozoans
(c) Slime mould (d) Euglenoids

50 Plant-like nutrition is present in

(a) *Amoeba* (b) *Paramecium*
(c) *Euglena* (d) *Plasmodium*

51 Slime moulds are

(a) pathogenic (b) parasite
(c) saprophytic protists (d) autotrophic

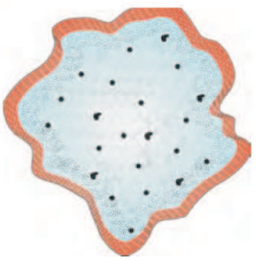
52 The free-living thalloid body of the slime mould is known as

(a) protonema (b) plasmodium
(c) fruiting body (d) mycelium

53 Under favourable conditions slime moulds form

(a) protonema (b) plasmodium
(c) mycelium (d) fruiting bodies

54 Identify the given figure and select the correct option.



(a) It is marine water plankton
(b) It is a saprophytic protist
(c) It is parasitic predator believed to but primary relative of animals
(d) Ciliated protozoan

55 Ciliates differ from all other protozoans in ***NEET 2018***

(a) using pseudopodia for capturing prey
(b) having a contractile vacuole for removing excess water
(c) using flagella for locomotion
(d) having two types of nuclei

56 Protozoans are

(a) heterotrophs (b) autotrophs
(c) producers (d) saprophytes

57 Which of the following group is considered as primitive relatives of animals?

(a) Chrysophytes (b) Protozoans
(c) Euglenoids (d) Slime moulds

58 Protozoans are divided into …… groups. Most suitable word to fill the blank is

(a) three (b) four
(c) two (d) eight

59 Which of the following groups belong to protozoans?

(a) Amoeboid, flagellates, ciliates, sporozoans
(b) Diatoms, amoeboid, ciliates, sporozoans
(c) Desmids, ciliates, flagellates, amoebiod
(d) Dinoflagellates, ciliates, *Plasmodium*, amoeboid

60 Flagellate protozoans are
(a) free-living only
(b) parasites only
(c) either free-living or parasites
(d) saprophytes

61 Which of the following is a flagellated protozoan?
(a) *Amoeba* (b) *Entamoeba*
(c) *Plasmodium* (d) *Trypanosoma*

62 *Trypanosoma* causes
(a) sleeping sickness (b) cholera
(c) malaria (d) food poisoning

63 *Paramecium* is an aquatic and actively moving organism due to the presence of
(a) pseudopodia
(b) false feet
(c) thousands of cilia
(d) flagella

64 Which of the following groups always produce an infectious spore-like stage in their life cycle?
(a) Amoeboid protozoans
(b) Ciliated protozoans
(c) Flagellated protozoans
(d) Sporozoans

65 *Plasmodium* is a
(a) ciliated protozoan (b) sporozoan
(c) flagellated protozoan (d) amoeboid protozoan

66 Which one of the following organisms is scientifically incorrectly named and incorrectly described?
(a) *Plasmodium falciparum*–A protozoan pathogen causing the most serious type of malaria
(b) *Trypanosoma gambiense*–The parasite of sleeping sickness
(c) Diatoms–Very good pollution indicators
(d) *Noctiluca*–A chrysophyte, which shows bioluminescence

TOPIC 3~ *Kingdom–Fungi*

67 The body of a fungus is made up of a number of elongated, tubular filaments called
(a) hyphae (b) Woronin bodies
(c) mycelium (d) thallus

68 Cell wall of fungi is composed of ***JIMPER 2018***
(a) chitin (b) pectin
(c) cellulose (d) mannans

69 Which one of the following is wrong for fungi? ***NEET 2016***
(a) They are eukaryotic
(b) All fungi possess a purely cellulosic cell wall
(c) They are heterotrophic
(d) They are both unicellular and multicellular

70 Which of the following is a non-hyphal unicellular fungus?
(a) Yeast (b) *Puccinia*
(c) *Ustilago* (d) *Alternaria*

71 Which of the following options describe the coenocytic condition in fungus?
(a) Uninucleate hypha without septum
(b) Multinucleate hypha without septum
(c) Multicellular hypha
(d) Multiciliate hypha

72 Fungi that absorb soluble organic matter from dead substrates are called
(a) saprophytes
(b) parasites
(c) obligate parasite
(d) lichens

73 Fungi that absorb nutrients directly from the cytoplasm of living host are called
(a) saprophytes (b) parasites
(c) symbionts (d) mycorrhiza

74 Mycorrhizae are mutualistic and symbiotic associations between
(a) fungi and vascular plants
(b) fungi and non-vascular plants
(c) fungi and roots of higher plants
(d) fungi and bryophytes

75 Mycorrhiza promotes the plant growth by
(a) absorbing inorganic ions from soil
(b) helping the plant in utilising atmospheric nitrogen
(c) protecting the plant from infection
(d) serving as plant growth regulator

76 Fungi show vegetative reproduction by all of the following methods except
(a) by fragmentation (b) by fission
(c) by budding (d) by protonema

77 Fungi show asexual reproduction by all of the following kinds of spores except
(a) conidia (b) oospores
(c) sporangiospores (d) zoospores

78 Fungi show sexual reproduction by all of the following processes except
(a) oospores
(b) ascospores
(c) basidiospores
(d) zoospores

79 In fungi, the various types of spores are produced in distinct structures known as
(a) fruiting body (b) spore sac
(c) peristome (d) pollen sac

80 In fungi, the fusion of protoplasms between two motile or non-motile gametes is called
(a) plasmogamy (b) plasmokinesis
(c) karyogamy (d) cytokinesis

81 In fungi, karyogamy is the fusion of two
(a) gametes (b) nuclei (c) cells (d) cytoplasm

82 Which of the following is the correct sequence of Class → Mycelium→ Fruiting body observed in the kingdom–Fungi?
(a) Phycomycetes → Septate, coenocytic → Not present
(b) Ascomycetes → Aseptate and branched → Ascocarp
(c) Basidiomycetes → Aseptate and branched → Basidiocarp
(d) Deuteromycetes → Septate and branched → Not present

83 In some fungi, two haploid cells result in a diploid cell. In some cases, dikaryon stage occurs in which two nuclei are present within a cell. This phase is known as
(a) monokaryophase (b) dikaryophase
(c) plasmogamy (d) karyogamy

84 Dikaryophase of fungus occurs in
(a) Ascomycetes and Basidiomycetes
(b) Phycomycetes and Ascomycetes
(c) Phycomycetes and Basidiomycetes
(d) Basidiomycetes and Deuteromycetes

85 Fungi are divided into four classes on the basis of
(a) morphology of the mycelium
(b) mode of spore formation
(c) fruiting bodies
(d) All of the above

86 *Rhizopus* is included in the class
(a) Ascomycetes (b) Phycomycetes
(c) Basidiomycetes (d) Deuteromycetes

87 Which of the following classes consists of coenocytic, multinucleate and aseptate mycelium?
(a) Basidiomycetes (b) Ascomycetes
(c) Phycomycetes (d) Deuteromycetes

88 Phycomycetes are most commonly found as
(a) obligate parasite
(b) obligate saprophyte
(c) coprophilous component
(d) Both (a) and (b)

89 In Phycomycetes, asexual reproduction occurs by
(a) zoospores (b) aplanospores
(c) Both (a) and (b) (d) conidia

90 Isogamous means gametes
(a) similar in morphology
(b) similar in anatomy
(c) female gamete is bigger than male gamete
(d) male gamete is bigger than female gamete

91 Which of the following is a parasitic fungi on mustard?
(a) *Rhizopus* (b) *Albugo*
(c) *Agaricus* (d) *Neurospora*

92 All of the following fungi belong to Phycomycetes, except
(a) *Rhizopus* (b) *Mucor* (c) *Albugo* (d) *Agaricus*

93 The hyphae of *Rhizopus* are
(a) unbranched, aseptate and uninucleate
(b) branched, aseptate and multinucleate
(c) branched, septate and uninucleate
(d) unbranched, septate and coenocytic

94 Ascomycetes are commonly known as
(a) toad stool (b) sac fungi
(c) imperfect fungi (d) bracket fungi

95 Yeast and *Penicillium* are the examples of class
(a) Phycomycetes (b) Ascomycetes
(c) Deuteromycetes (d) Basidiomycetes

96 Members of Ascomycetes are
(a) saprophytic (b) decomposers
(c) parasitic or coprophilous (d) All of these

97 *Claviceps* is a member of
(a) Ascomycetes (b) Basidiomycetes
(c) Zygomycetes (d) Phycomycetes

98 Which of the following fungus is used extensively in biochemical and genetic work?
(a) *Neurospora* (b) *Mucor*
(c) *Rhizopus* (d) *Aspergillus*

99 Identify the edible and delicate Ascomycetes members.
(a) *Agaricus* and *Puccinia* (b) Morels and truffles
(c) Puffball and *Agaricus* (d) Puffball and mushrooms

100 Which of the following are the commonly known forms of Basidiomycetes?
(a) Mushrooms (b) Puffball
(c) Bracket fungi (d) All of these

101 Where the members of Basidiomycetes occur?
(a) Soil
(b) Logs
(c) Tree stumps and living plant bodies
(d) All of the above

102 In Basidiomycetes, the mycelium is
(a) branched and aseptate (b) branched and septate
(c) unbranched and septate (d) coenocytic

103 In Basidiomycetes, vegetative reproduction occurs by
(a) endospores (b) conidia
(c) akinetes (d) fragmentation

104 Among rust, smut and mushroom, all the three
(a) are pathogens (b) are saprobes
(c) bear ascocarps (d) bear basidiocarps

105 All of the following fungi belong to Basidiomycetes, except
(a) *Agaricus* (b) *Ustilago* (c) *Puccinia* (d) *Alternaria*

106 Which of the following are the common parasites of class–Basidiomycetes?
(a) *Ustilago* and *Puccinia*
(b) *Agaricus* and *Trichoderma*
(c) *Alternaria* and *Colletotrichum*
(d) *Colletotrichum* and *Puccinia*

107 In Deuteromycetes, the mycelium is
(a) septate and branched (b) septate and unbranched
(c) coenocytic (d) multinucleated

108 The imperfect fungi, which are decomposers of litter and help in mineral cycling belong to
CBSE-AIPMT 2015
(a) Deuteromycetes (b) Basidiomycetes
(c) Phycomycetes (d) Ascomycetes

109 Deuteromycetes reproduce only by asexual spores known as
(a) conidia (b) endospores
(c) zoospores (d) heterocyst

110 Sexual reproduction is present in all fungi classes, except
(a) Ascomycetes (b) Phycomycetes
(c) Basidiomycetes (d) Deuteromycetes

111 All the given fungi belong to Deuteromycetes, except
(a) *Alternaria*
(b) *Colletotrichum*
(c) *Trichoderma*
(d) *Ustilago*

112 Which one of the following matches is correct?
CBSE-AIPMT 2015

(a)	*Phytophthora*	Aseptate mycelium	Basidiomycetes
(b)	*Alternaria*	Sexual reproduction absent	Deuteromycetes
(c)	*Mucor*	Reproduction by conjugation	Ascomycetes
(d)	*Agaricus*	Parasitic fungus	Basidiomycetes

113 Select the incorrect match.
(a) Morels and truffles — Phycomycetes
(b) Mushrooms and puffballs — Basidiomycetes
(c) Smut and rust — Basidiomycetes
(d) Bread mould — Phycomycetes

TOPIC 4 ~ *Kingdom–Plantae and Animalia*

114 Insectivorous plants are
(a) autotrophic (b) partially heterotrophic
(c) parasitic (d) pathogenic

115 Which of the following are the examples of insectivorous plant?
(a) Bladderwort (b) Venus flytrap
(c) *Nepenthes* (d) All of these

116 *Cuscuta* is a/an
(a) parasite (b) pathogen
(c) saprophyte (d) autotroph

117 Plants show ..... in their life cycle.
(a) only sexual phase (b) only asexual phase
(c) alternation of generations (d) None of these

118 Which of the given options best describes the gametophyte in the alternation of generations of a plant's life cycle?
(a) Generation that produces gametes
(b) Generation that produces spores
(c) Generation that has xylem and phloem
(d) The diploid generation

119 Which of these best describe the sporophytic generation in plant's life cycle?
(a) The haploid generation
(b) Generation that produces gametes
(c) Generation that produces spores
(d) Generation that has xylem and phloem

120 Kingdom–Animalia includes
(a) heterotrophic organisms
(b) eukaryotic organisms
(c) multicellular organisms
(d) All of the above

121 The reserve food material of animals is
(a) glycogen or animal fat (b) glucose
(c) cellulose (d) chitin

122 Which of the following is not a feature of kingdom–Animalia?
(a) Lack cell wall
(b) Holozoic mode of nutrition
(c) A definite growth pattern
(d) Chlorophyllous

TOPIC 5 ~ *Viruses, Viroids, Prions and Lichens*

123 Viruses and viroids are the non-cellular organisms, which are not characterised in the classification of
(a) Whittaker (b) Aristotle (c) Linnaeus (d) Watson

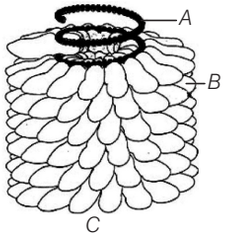
124 Viruses did not find a place in classification since
(a) they are not truely living (b) they are non-cellular
(c) they are obligate parasite (d) they are pathogenic

125 Viruses are non-cellular organisms but replicate themselves once they infect the host cell. To which of the following kindgom viruses belong to?
(a) Monera (b) Protista (c) Fungi (d) None of these

126 Which of the following phenomenon proves that viruses are living?
(a) They carry metabolic activity
(b) They carry anaerobic respiration
(c) They multiply in host cells
(d) They cause infection

127 Tobacco mosaic virus is
(a) spherical (b) rod-shaped
(c) cuboidal (d) oval

128 Given below is the diagram of a virus. In which one of the options, all the three *A, B* and *C* (name of the virus) are correct?



(a) A–RNA, B–Capsomere, C–Tobacco mosaic virus
(b) A–DNA, B–Capsid, C–Bacteriophage
(c) A–RNA, B–Capsid, C–Tobacco mosaic virus
(d) A–DNA, B–Capsid, C–Bacteriophage

129 The genetic material of viruses consists of
(a) *ds* or *ss*DNA only
(b) *ds* or *ss*RNA only
(c) DNA or RNA (Both *ds* and *ss*)
(d) *ss*DNA or *ss*RNA

130 The protein coat of a virus is known as
(a) nucleoid (b) capsid
(c) capsomere (d) outer envelope

131 The subunit of capsid is called
(a) capsomere (b) core
(c) nucleoside (d) nucleotide

132 Viruses are also known as
(a) nucleoprotein particles (b) virion
(c) lipoprotein particles (d) core

133 The latest view for the origin of viruses is
(a) they have arisen from nucleic acid and proteins found in primitive soup
(b) they arose from bacteria as a result of the loss of cell wall, ribosome, etc.
(c) they arose from some bacteria, which had developed a nucleus only
(d) they are modified plasmids, which are infect the fragments of the nucleic acids of the host

134 The genetic material of rabies virus is
(a) double-stranded RNA (b) single-stranded RNA
(c) double-stranded DNA (d) single-stranded DNA

135 The non-living characteristic of viruses is
(a) ability to multiply only inside the host
(b) ability to cause diseases in the host
(c) ability to undergo mutation
(d) ability of crystallisation

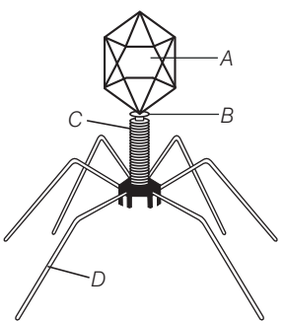
136 Which of the following groups of diseases is caused by viruses?
(a) Mumps, smallpox, herpes, influenza
(b) AIDS, diabetes, herpes, tuberculosis
(c) Anthrax, cholera, tetanus, tuberculosis
(d) Cholera, tetanus, smallpox, influenza

137 In plants, mosaic formation, leaf rolling and curling, yellowing and vein clearing are the symptoms of
(a) viral diseases (b) bacterial diseases
(c) protozoan diseases (d) fungal diseases

138 Which of the following plant viruses has DNA?
(a) Tobacco mosaic virus (b) Potato mosaic virus
(c) Tomato mosaic virus (d) Cauliflower mosaic virus

139 Bacteriophages are
(a) bacteria that attack viruses
(b) viruses that attack bacteria
(c) free-living viruses
(d) free-living bacteria

140 Identify the label *A*, *B*, *C* and *D* in the following figure.



(a) A–Head, B–Collar, C–Sheath, D–Tail fibres
(b) A–Collar, B–Head, C–Sheath, D–Tail fibres
(c) A–Head, B–Collar, C–Tail fibres, D–Sheath
(d) A–Collar, B–Tail fibres, C–Head, D–Sheath

141 A new infectious agent that is smaller than virus is
(a) prion (b) viroid (c) bacteria (d) mycoplasma

142 Viroids differ from viruses in having ***NEET 2017***
(a) DNA molecules with protein coat
(b) DNA molecules without protein coat
(c) RNA molecules with protein coat
(d) RNA molecules without protein coat

143 Lichens are mutualistic and symbiotic associations between
(a) mycobiont and virus
(b) mycobiont and phycobiont
(c) mycobiont and root of higher plants
(d) mycobiont and mosses

144 The advantage of fungus in lichen is
(a) food
(b) anchoring
(c) mineral absorption
(d) Both (b) and (c)

145 The benefit given by algae in lichen is
(a) food for fungi
(b) shelter
(c) mineral absorption
(d) protection

146 Which of the following are most suitable indicators of SO_2 pollution in the environment? ***CBSE-AIPMT 2015***
(a) Lichens (b) Conifers (c) Algae (d) Fungi

147 Which of the following would appear as the pioneer organisms on bare rocks? ***NEET 2016***
(a) Liverworts (b) Mosses
(c) Green algae (d) Lichens

NEET

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

■ **Direction** (Q. 148-157) *In each of the following questions, a statement of Assertion (A) is given by corresponding statement of Reason (R). Of the statements, mark the correct answer as*
(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true, but R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

148 **Assertion** (A) The two kingdom classification, used for a long time, was found to be inadequate.

Reason (R) Two kingdom system of classification did not distinguish between the eukaryotes and prokaryotes, unicellular and multicellular organisms and green algae and fungi.

149 **Assertion** (A) Five kingdom system of classification did not differentiated between the heterotrophic group, fungi and the autotrophic green plants. Though they showed a characteristic difference in their cell wall composition.

Reason (R) Fungal cell wall contains chitin, while green plants have a cellulosic cell wall.

150 **Assertion** (A) *Euglena* is a plant due to the presence of chlorophyll.

Reason (R) *Euglena* cannot be classified on the basis of two kingdom system.

151 **Assertion** (A) Fungi are wide spread in distribution and they can even live on or inside other plants and animals.

Reason (R) Fungi are able to grow anywhere on land, water or on other organisms because they have variety of pigments including chlorophyll, carotenoids, fucoxanthin and phycoerythrin.

152 **Assertion** (A) In fungi, sexual apparatus decreases in complexity from lower to higher forms.

Reason (R) In algae, sexual apparatus increases in complexity from simple to higher forms.

153 **Assertion** (A) Viruses cause diseases and replicate when they are in the host cell.

Reason (R) Viruses do not replicate outside the host, but they survive in environment.

154 **Assertion** (A) Polluted water bodies have high abundance of *Nostoc* and *Oscillatoria*.

Reason (R) These blue-green bacteria can tolerate adverse conditions very well compared to other aquatic plants.

155 **Assertion** (A) Slime moulds are called as fungus like animals.

Reason (R) These do not have cell wall.

156 **Assertion** (A) Kingdom–Plantae includes all eukaryotic, chlorophyll containing organisms.

Reason (R) Few of its members are partially heterotrophic.

157 **Assertion** (A) Three domains system classifies organisms based on cellular characteristics.

Reason (R) The three domains are, i.e. archaea, bacteria and eukarya.

II. Statement Based Questions

158 Which of the statements given below is correct?

(a) Biological classification is the scientific ordering of organisms in a hierarchial series of groups on the basis of their relationships, i.e. morphological, evolutionary and others

(b) Whittaker classified organisms on the basis of autotrophic and heterotrophic mode of nutrition

(c) In five kingdom system of classification, living organisms can be divided into prokaryotic and eukaryotic cells on the basis of cell structure

(d) All of the above

159 Consider the following statements. Which of the statements given below is incorrect?

(a) All prokaryotic organisms were grouped together under kingdom–Monera

(b) The unicellular eukaryotic organisms were placed in kingdom–Protista

(c) *Chlorella* and *Chlamydomonas*, both lack cell walls

(d) *Paramecium* and *Amoeba* lack cell walls

160 Choose the incorrect statement about members of kingdom–Monera.

(a) Many of them live in or on other organisms as parasites

(b) Some synthesise their own food from inorganic solutes

(c) Bacterial structure is very complex though they have very simple behaviour

(d) Hundreds of bacteria are present in handful of soil

161 Read the following statements about bacteria and select the correct option.

(a) Bacteria are simple in structure, but complex in behaviour

(b) Bacteria are complex in structure, but simple in behaviour

(c) Bacteria are simple in both structure and behaviour

(d) Bacteria are complex in both structure and behaviour

162 Which of the following statements about methanogens is not correct? ***NEET (Odisha) 2019***

(a) They can be used to produce biogas

(b) They are found in the rumen of cattle and their excreta

(c) They grow aerobically and breakdown cellulose rich food

(d) They produce methane gas

163 In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements is true about archaea?

(a) Archaea resemble eukarya in all respects

(b) Archaea have some noble features that are absent in other prokaryotes and eukaryotes

(c) Archaea completely differ from both prokaryotes and eukaryotes

(d) Archaea completely differ from prokaryotes

164 Which of the following statements is/are incorrect?

(a) Bacteria reproduce only by binary fission

(b) Under unfavourable conditions, bacteria produce several types of spores

(c) Bacteria reproduce by a sort of sexual reproduction by adopting a primitive type of RNA transfer from one bacterium to other

(d) Both (a) and (b)

165 Which one of the following statements is incorrect?

(a) Golden algae are also called desmids ***NEET 2016***

(b) Eubacteria are also called false bacteria

(c) Phycomycetes are also called algal fungi

(d) Cyanobacteria are also called blue-green algae

166 Which statement is correct? ***AIIMS 2019***

(a) Mycoplasma is smallest and wall less living organism

(b) Influenza and herpes are caused by virus having DNA and RNA

(c) *Nostoc* and *Anabaena* are important decomposers

(d) Methanogen are methane producing bacteria in wheat crops

167 Select the incorrect statement. ***NEET 2016***

(a) Bacterial cell wall is made up of peptidoglycan

(b) Pili and fimbriae are mainly involved in motility of bacterial cells

(c) Cyanobacteria lack flagellated cells

(d) Mycoplasma is a wall-less microorganism

168 Consider the following statements about mycoplasma. Which of the statement given below is incorrect?

(a) They are pleomorphic bacteria, which lack cell wall

(b) Mycoplasma is the smallest living organism

(c) They cannot survive without oxygen

(d) Many mycoplasma are pathogenic in animals and plants

169 Select the incorrect statement. ***NEET 2016***

(a) The walls of diatoms are easily destructible
(b) 'Diatomaceous earth' is formed by the cell walls of diatoms
(c) Diatoms are chief producers in the oceans
(d) Diatoms are microscopic and float passively in water

170 Which of the following following statement about *Euglena* is/are true?

(a) Euglenoids bear flagella
(b) *Euglena* when placed in continuous darkness, loose their photosynthetic activity and die
(c) The pigments of *Euglena* are quite different from those of green plants
(d) *Euglena* is a marine protist

171 Which of the following statement(s) given below is/are incorrect?

(a) Diatomite is porous and chemically inert. It is therefore, used in filtration of sugars, alcohols, oils, syrups and antibiotics
(b) Diatomite deposits are often accompanied by petroleum fields
(c) Both (a) and (b)
(d) Desmids are mainly found in dirty water and are usually indication of polluted water

172 Which of the statement(s) given below is/are correct for amoeboid protozoans?

(a) Live in freshwater, sea water or moist soil
(b) Has pseudopodia for locomotion and capturing prey
(c) Have silica shells on their surface in marine forms
(d) All of the above

173 Which of the following statements is correct?

(a) Slime moulds are haploid
(b) Protozoans lack cell wall
(c) Dinoflagellates are immotile
(d) Pellicle is absent in *Euglena*

174 Consider the following statements about Ascomycetes. Which one of the statement given below is false?

(a) They are saprophytic, decomposer, coprophilous and parasitic
(b) Include unicellular and multicellular forms
(c) Mycelium is coenocytic and aseptate
(d) *Aspergillus*, *Claviceps* and *Neurospora* are important examples of Ascomycetes

175 Which of the following statement is incorrect? ***NEET (National) 2019***

(a) *Claviceps* is a source of many alkaloids and LSD
(b) Conidia are produced exogenously and ascospores endogenously
(c) Yeasts have filamentous bodies with long thread-like hyphae
(d) Morels and truffles are edible delicacies

176 Which of the following statement is correct? ***NEET (Odisha) 2019***

(a) Lichens do not grow in polluted areas
(b) Algal component of lichens is called mycobiont
(c) Fungal component of lichens is called phycobiont
(d) Lichens are not good pollution indicators

177 Which of the following statement(s) is/are incorrect?

(a) Protistan body includes a well-defined nucleus, and all cellular organelles
(b) Protists have nucleus along with flagella and cilia
(c) Protist cells have no nucleus but have some cellular organelles to perform basic functions
(d) All of the above

178 Which of the statement(s) given below is/are correct?

(a) Kingdom–Protista forms a link between monerans and the other organisms like plants, animal and fungi
(b) Protists reproduce asexually and sexually by a process involving cell fusion and zygote formation
(c) Being eukaryotes, the protistan cell body contains a well-defined nucleus and other membrane bound organelles
(d) All of the above

179 Which of the following statement about plant is false?

(a) Plants are heterotrophs
(b) Plants show alternation of generations during their life cycle
(c) Plants are multicellular eukaryotes
(d) Plants are non-motile

180 Which of the following statement is incorrect?

(a) Viruses are obligate parasites ***NEET (National) 2019***
(b) Infective constituent in viruses is the protein coat
(c) Prions consist of abnormally folded proteins
(d) Viroids lack a protein coat

181 Select incorrect statement. ***CBSE-AIPMT 2015***

(a) The viroids were discovered by DJ Ivanowsky
(b) WM Stanley showed that viruses could be crystallised
(c) The term *'Contagium vivum fluidum'* was coined by MW Beijerinck
(d) Mosaic disease in tobacco and AIDS in human being are caused by viruses

182 State whether the given statements are true or false.

I. Bacteria show both autotrophic and heterotrophic nutrition.
II. Some of the bacteria are autotrophic. They may be photosynthetic autotrophic or chemosynthetic autotrophic.
III. Heterotrophic nutrition involves obtaining of readymade organic food from outside sources.

(a) I and II are true
(b) I is true, II and III are false
(c) I, II and III are true
(d) Only I is true

183 Read the following statements regarding archaebacteria and select the correct option.

I. Archaebacteria differ from other bacteria in having different cell wall structure.

II. Their cell wall is made up of cellulose and contains high amount of unsaturated fatty acid, which is responsible for their survival in extreme conditions.

III. Thermoacidophiles have dual ability to tolerate high temperature as well as high acidity.

Which of the statements given above are correct?

(a) I and II
(b) I and III
(c) II and III
(d) All of the above

184 Analyse the following statements and identify the correct option given below.

I. In diatoms the walls are embedded with silica and thus the walls are indestructible.

II. Diatoms have left behind large amount of cell wall deposits in their habitat, this accumulation over billions of years is referred to as diatomaceous deposition or diatomaceous earth.

(a) I is true, but II is false
(b) I is false, but II is true
(c) I and II are true
(d) I and II are false

185 The given statements describe a group of organisms.

I. Instead of a cell wall, they have a protein rich layer called pellicle which makes their body flexible.

II. They have two flagella, a short and a long one.

III. They are photosynthetic in the presence of sunlight, when deprived of sunlight they behave like heterotrophs by predating on other smaller organisms.

IV. They are connecting link between plants and animals.

Which of the following group is referred to here by the above statements?

(a) Slime moulds
(b) Dinoflagellates
(c) Euglenoids
(d) Protozoans

186 Consider the following statements about slime moulds.

I. Plasmodium is found in acellular slime moulds.

II. Pseudoplasmodium is found in cellular slime moulds.

Which of the statement(s) given above is/are correct?

(a) I is true, but II is false
(b) Both I and II are false
(c) I is false, but II is true
(d) Both I and II are true

187 Consider the following statements.

I. In this group, the plasmodium differentiates and forms fruiting bodies, bearing spores at their tips.

II. Spores possess true walls.

III. The spores are dispersed by air currents.

IV. The spores are extremely resistant and survive for many years even under adverse conditions.

The above statements are assigned to

(a) euglenoids (b) slime moulds
(c) dinoflagellates (d) chrysophytes

188 Consider the following statements.

I. Bruce discovered that the parasite of sleeping sickness is transmitted by tse-tse fly.

II. Sleeping sickness of *Trypanosoma gambiens* is also called gambian trypanosomiasis, which is found in Western and central parts of Africa.

III. *Trichomonas vaginalis* inhabits vagina of women and causes the disease leucorrhoea.

IV. *Entamoeba histolytica* resides in the upper part of the human's large intestine and causes the disease known as amoebic dysentery.

Which of the statements given above are correct?

(a) I, II and III (b) II, III and IV
(c) I, II and IV (d) All of these

189 Consider the following statements and place them into true and false category.

I. The fungi constitute a unique kingdom of heterotrophic organisms.

II. The common mushroom and toad stools are fungi.

III. White spots seen on mustard leaves are due to the presence of parasitic fungus.

IV. Some unicellular fungi (*Ustilago*) are used to make bread and beer.

V. *Puccinia graminis tritici* is responsible for yellow rust of wheat.

VI. *Penicillium* yields the antibiotic penicillin.

	True	**False**
(a)	I, II, III	IV, V, VI
(b)	I, II, III, VI	IV, V
(c)	II, III, VI	I, IV, V
(d)	IV, V	I, II, III, VI

190 In Phycomycetes, asexual reproduction takes place by zoospores or by aplanospores. Regarding these spores, consider the following statements and choose the correct option.

I. Zoospores are motile and aplanospores are non-motile in nature.

II. These spores are endogenously produced in sporangium.

Which of the statements are true and false?

(a) I is true, but II is false (b) I is false, but II is true
(c) I and II are true (d) I and II are false

191 Consider the following statements about sexual reproduction.

I. In class–Phycomycetes, sexual reproduction produces a resting diploid spore called zygospore.

II. Zygospores are formed by the fusion of two gametes.

III. All zygospores are of isogamous type.

Which of the statements given above are correct?

(a) I and II (b) I and III (c) II and III (d) All of these

192 Analyse the following statements about class–Ascomycetes.

I. Mycelium is branched and septate.

II. The asexual spores are conidia, produced on the special mycelium called conidiophores.

III. Sexual spores are called ascospores, which are produced in sac-like asci.

Which of the statements given above are correct?

(a) I and II (b) I and III (c) II and III (d) All of these

193 Consider the following statements.

I. Mycelium is branched and septate.

II. The asexual spores are generally not formed.

III. Vegetative reproduction takes place by fragmentation.

IV. Sex organs are absent, but sexual reproduction takes place by somatogamy.

V. Karyogamy and meiosis take place in basidium to form four haploid basidiospores.

VI. Basidia are arranged in fruiting bodies called basidiocarp.

The above statements are assigned to

(a) sac fungi (b) bracket fungi

(c) imperfecti fungi (d) club fungi

194 Consider the following statements about Deuteromycetes.

I. Some members are saprophytes or parasites.

II. A large number of members are decomposers of litter and help in mineral cycling.

III. *Alternaria*, *Colletotrichum*, *Cercospora* and *Trichoderma* are examples of Deuteromycetes.

Which of the statements given above are correct?

(a) I and II (b) I and III (c) II and III (d) All of these

195 Consider the following statements about plants.

I. Kingdom–Plantae includes eukaryotic, autotrophic, chlorophyll containing organisms.

II. It includes algae, bryophytes, pteridophytes, gymnosperms, but not angiosperms.

III. Plants show alternation of generation [between haploid gametophytic (n) phase and diploid sporophytic ($2n$) phase].

Which of the statements given above are correct?

(a) I and II (b) I and III (c) II and III (d) All of these

196 Organisms of kingdom–Animalia

I. are capable of locomotion.

II. have specialised sensory and neuromotor system.

III. show sexual reproduction by copulation of male and female followed by embryological development.

Which of the statements given above is/are correct?

(a) I and II (b) I and III

(c) Only I (d) All of these

197 I. DJ Ivanowsky (1892) recognised certain microbes as causal organisms of the mosaic disease of tobacco.

II. MW Beijerinck (1898) demonstrated that the extract of infected plants of tobacco could cause infection in healthy plants and called the fluid as *Contagium vivum fluidum*.

III. WM Stanley (1935) showed that these microbes could be crystallised and crystals consist largely of protein.

The above statements are assigned to

(a) Bacteria (b) Virus

(c) Prions (d) Lichens

198 Which of the following statements are false about viruses?

I. Viruses are facultative parasites.

II. Viruses can multiply only when they are inside the living cells.

III. Viruses cannot pass bacterial proof filters.

IV. Viruses do not contain proteins, DNA and RNA.

(a) I, II and III (b) II, III and IV

(c) I, III and IV (d) All of these

199 TO Diener (1971) discovered a new infectious agent that was smaller than viruses.

Consider the following statements about this infectious agent.

I. It causes potato spindle tuber disease.

II. These are infectious RNA particles.

III. It lacks a protein coat.

IV. The molecular weight of its RNA is low.

The above statements are assigned to

(a) viruses (b) viroids

(c) prions (d) lichen

200 Study the following statements and identify the correct option given below.

I. Viruses that infect plants have single-stranded RNA and viruses that infect animals have either single or double-stranded RNA or double-stranded DNA.

II. Bacterial viruses or Bacteriophages are usually single-stranded RNA viruses.

(a) I is true, but II is false

(b) I is false, but II is true

(c) I and II are true

(d) I and II are false

201 Which of the following statements correctly describe viruses?

I. Simple and unicellular organisms.
II. Contain DNA or RNA and enclosed by protein coat.
III. Possess own metabolic system and respond to stimuli.
IV. Maintain genetic continuity and undergo mutations.

The correct combination is

(a) I and II (b) II and IV (c) II and III (d) I and III

III. Matching Type Questions

202 Match the following columns.

	Column I (Systems of classification)		Column II (Given by)
A.	Two kingdom system of classification	1.	RH Whittaker
B.	Five kingdom system of classification	2.	Carl Woese
C.	Six kingdom system of classification	3.	Carolus Linnaeus

Codes

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

203 Match the following columns.

	Column I (Names)		Column II (Shape)
A.	Coccus	1.	Rod-shaped
B.	Bacillus	2.	Spherical
C.	Vibrio	3.	Spiral-shaped
D.	Spirillum	4.	Comma-shaped

Codes

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

204 Match the following bacterial nutrition with their representative organisms.

	Column I (Types of bacteria)		Column II (Examples)
A.	Chemoautotrophic bacteria	1.	Nitrifying bacteria
B.	Photoautotrophic bacteria	2.	Purple bacteria, green sulphur bacteria
C.	Symbiotic bacteria	3.	*Rhizobium, Frankia*
D.	Parasitic bacteria	4.	*Vibrio cholerae*

Codes

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

205 Match the organisms in Column I with habitats in Column II and choose the correct option from the codes given below. ***NEET (Odisha) 2019***

	Column I		Column II
A.	Halophiles	1.	Hot springs
B.	Thermoacidophiles	2.	Aquatic environment
C.	Methanogens	3.	Guts of ruminants
D.	Cyanobacteria	4.	Salty area

Codes

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

206 Match the following columns.

	Column I (Features)		Column II (Protista)
A.	Chief producer in the oceans	1.	Diatoms
B.	Red tide	2.	Dinoflagellates
C.	Connecting link between plants and animals	3.	Euglenoids
D.	Fungus animals	4.	Slime moulds

Codes

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

207 Match the following columns.

	Column I (Types)		Column II (Examples)
A.	Amoeboid protozoans	1.	*Plasmodium*
B.	Flagellated protozoans	2.	*Paramecium*
C.	Ciliated protozoans	3.	*Trypanosoma*
D.	Sporozoans	4.	*Entamoeba histolytica*

Codes

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

208 Match the following columns and choose the correct option from the codes given below. ***AIIMS 2019***

	Column I (Categories)		Column II (Examples)
A.	Chrysophyte	1.	*Gonyaulax*
B.	Dinoflagellate	2.	*Euglena*
C.	Euglenoids	3.	Diatoms
D.	Slime moulds	4.	*Plasmodium*

Codes

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

209 Match the following columns.

	Column I (Categories)		Column II (Examples)
A.	Phycomycetes	1.	*Alternaria* and *Trichoderma*
B.	Ascomycetes	2.	*Agaricus* and *Ustilago*
C.	Basidiomycetes	3.	*Aspergillus*, *Claviceps* and *Neurospora*
D.	Deuteromycetes	4.	*Mucor*, *Rhizopus* and *Pythium*

Codes

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

210 Match the following columns.

	Column I (Categories)		Column II (Common names)
A.	Phycomycetes	1.	Algal fungi
B.	Ascomycetes	2.	Imperfect fungi
C.	Basidiomycetes	3.	Bracket fungi
D.	Deuteromycetes	4.	Sac fungi

Codes

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

211 Match the following columns.

	Column I (Features)		Column II (Related to)
A.	Parasitic fungi on mustard	1.	*Neurospora*
B.	Rust and smut disease	2.	*Puccinia* and *Ustilago*
C.	Used in genetic work	3.	Morels and truffles
D.	Edible delicacies	4.	*Albugo*
E.	Bread mould	5.	*Rhizopus*

Codes

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

212 Match the following columns.

	Column I (Names of fungi)		Column II (Categories)
A.	*Rhizopus*	1.	Eurotiomycetes
B.	*Penicillium*	2.	Ustilagomycetes
C.	*Ustilago*	3.	Deuteromycetes
D.	*Alternaria*	4.	Zygomycetes

Codes

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

213 Match Column I with Column II.

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	Column I		Column II
A.	Saprophyte	1.	Symbiotic association of fungi with plant roots
B.	Parasite	2.	Decomposition of dead organic materials
C.	Lichens	3.	Living on living plants or animals
D.	Mycorrhiza	4.	Symbiotic association of algae and fungi

Codes

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

214 Match the following columns.

	Column I (Scientists)		Column II (Related to)
A.	DJ Ivanowsky (1892)	1.	Viroids
B.	MW Beijerinck (1898)	2.	First crystallised TMV
C.	WM Stanley (1935)	3.	*Contagium vivum fluidum*
D.	TO Diener (1971)	4.	Mosaic disease of tobacco

Codes

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

215 Match the following columns.

	Column I (Viruses)		Column II (Genetic materials)
A.	M-13 bacteriophage	1.	*ds*RNA
B.	Rice dwarf virus	2.	*ss*RNA
C.	Cauliflower mosaic virus	3.	*ss*DNA
D.	Polio virus	4.	*ds*DNA

Codes

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

216 Match the following columns and choose the correct combination from the given options.

	Column I (Kingdoms)		Column II (Classes)
A.	Plantae	1.	Archaebacteria
B.	Fungi	2.	Euglenoids
C.	Protista	3.	Phycomycetes
D.	Monera	4.	Algae

Codes

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

NCERT & NCERT Exemplar

MULTIPLE CHOICE QUESTIONS

NCERT

217 Choose the incorrect statement amongst the following.
(a) Alternation of generations is well-marked in angiosperms
(b) Kingdom–Plantae includes prokaryotic photosynthetic organisms
(c) Mycoplasma is the smallest cellular organism, which. does not contain cell wall
(d) Potato spindle tuber disease is caused by viroid

NCERT Exemplar

218 All eukaryotic unicellular organisms belong to
(a) Monera (b) Protista (c) Fungi (d) Bacteria

219 Naked cytoplasm, multinucleated and saprophytic are the characteristics of
(a) Monera (b) Protista
(c) Fungi (d) Slime mould

220 Difference between virus and viroid is
(a) the absence of protein coat in viroid, but present in virus
(b) the presence of low molecular weight RNA in virus, but absent in viroid
(c) Both (a) and (b)
(d) None of the above

221 Viruses are non-cellular organisms, but replicate themselves once they infect the host cell. To which of the following kingdom do viruses belong to?
(a) Monera (b) Protista
(c) Fungi (d) None of these

222 An association between roots of higher plants and fungi is called
(a) lichen
(b) fern
(c) mycorrhiza
(d) BGA

223 The five kingdom classification was proposed by
(a) RH Whittaker (b) C Linnaeus
(c) A Roxberg (d) Virchow

224 Organisms living in salty areas are called as
(a) methanogens (b) halophiles
(c) heliophytes (d) thermoacidophiles

225 *Contagium vivum fluidum* was proposed by
(a) DJ Ivanowsky
(b) MW Beijerinck
(c) Stanley Miller
(d) Robert Hooke

226 A dikaryon is formed when
(a) meiosis is arrested
(b) the two haploid cells do not fuse immediately
(c) cytoplasm does not fuse
(d) None of the above

227 Association between mycobiont and phycobiont is found in
(a) mycorrhiza (b) root (c) lichens (d) BGA

228 With respect to fungal sexual cycle, choose the correct sequence of events.
(a) Karyogamy, Plasmogamy and Meiosis
(b) Meiosis, Plasmogamy and Karyogamy
(c) Plasmogamy, Karyogamy and Meiosis
(d) Meiosis, Karyogamy and Plasmogamy

229 Members of Phycomycetes are found in
I. aquatic habitats.
II. on decaying wood.
III. moist and damp places.
IV. as obligate parasites on plants.
Choose the correct answer from the following options.
(a) I and IV (b) Only III
(c) Only II (d) All of these

Answers

› Mastering NCERT with MCQs

1 (a)	2 (a)	3 (d)	4 (a)	5 (c)	6 (b)	7 (d)	8 (b)	9 (c)	10 (c)	11 (a)	12 (b)	13 (b)	14 (c)	15 (a)
16 (d)	17 (d)	18 (c)	19 (b)	20 (d)	21 (b)	22 (a)	23 (d)	24 (c)	25 (a)	26 (b)	27 (b)	28 (c)	29 (b)	30 (c)
31 (c)	32 (a)	33 (b)	34 (b)	35 (a)	36 (c)	37 (c)	38 (a)	39 (b)	40 (a)	41 (d)	42 (c)	43 (b)	44 (d)	45 (c)
46 (c)	47 (a)	48 (b)	49 (d)	50 (c)	51 (c)	52 (b)	53 (b)	54 (b)	55 (d)	56 (a)	57 (b)	58 (b)	59 (a)	60 (c)
61 (d)	62 (a)	63 (c)	64 (d)	65 (b)	66 (d)	67 (a)	68 (a)	69 (b)	70 (a)	71 (b)	72 (a)	73 (b)	74 (c)	75 (a)
76 (d)	77 (b)	78 (d)	79 (a)	80 (a)	81 (b)	82 (d)	83 (b)	84 (a)	85 (d)	86 (b)	87 (c)	88 (d)	89 (c)	90 (a)
91 (b)	92 (d)	93 (b)	94 (b)	95 (b)	96 (d)	97 (a)	98 (a)	99 (b)	100 (d)	101 (d)	102 (b)	103 (d)	104 (d)	105 (d)
106 (a)	107 (a)	108 (a)	109 (a)	110 (d)	111 (d)	112 (b)	113 (a)	114 (b)	115 (d)	116 (a)	117 (c)	118 (a)	119 (c)	120 (d)
121 (a)	122 (d)	123 (a)	124 (a)	125 (d)	126 (c)	127 (b)	128 (c)	129 (c)	130 (b)	131 (a)	132 (a)	133 (d)	134 (b)	135 (d)
136 (a)	137 (a)	138 (d)	139 (b)	140 (a)	141 (b)	142 (d)	143 (b)	144 (d)	145 (a)	146 (a)	147 (d)			

› NEET Special Types Questions

148 (a)	149 (d)	150 (d)	151 (c)	152 (b)	153 (b)	154 (a)	155 (c)	156 (b)	157 (b)	158 (d)	159 (c)	160 (c)	161 (a)	162 (c)
163 (b)	164 (a)	165 (b)	166 (a)	167 (b)	168 (c)	169 (a)	170 (a)	171 (d)	172 (d)	173 (b)	174 (c)	175 (c)	176 (a)	177 (c)
178 (d)	179 (a)	180 (b)	181 (a)	182 (c)	183 (b)	184 (c)	185 (c)	186 (d)	187 (b)	188 (d)	189 (b)	190 (c)	191 (d)	192 (d)
193 (b)	194 (d)	195 (b)	196 (d)	197 (b)	198 (c)	199 (b)	200 (a)	201 (b)	202 (d)	203 (c)	204 (a)	205 (a)	206 (b)	207 (b)
208 (d)	209 (c)	210 (c)	211 (d)	212 (c)	213 (c)	214 (c)	215 (a)	216 (a)						

› NCERT & NCERT Exemplar Questions

217 (b)	218 (b)	219 (d)	220 (a)	221 (d)	222 (c)	223 (a)	224 (b)	225 (b)	226 (b)	227 (c)	228 (c)	229 (d)

Answers & Explanations

1 (*a*) Aristotle classified plants into trees, shrubs and herbs. He used simple morphological characters as a tool for his classification. He also divided animals into two groups those which have red blood and those that did not.

2 (*a*) Earlier, all the organisms of the world had been divided into two kingdoms, i.e. plant kingdom and animal kingdom.

This system of classification was given by Carolus Linnaeus in the book *Systema Naturae* (1735).

4 (*a*) The five kingdom classification proposed by Whittaker includes Monera, Protista, Fungi, Plantae and Animalia.

Out of which four kingdoms, i.e. Protista, Fungi, Plantae and Animalia contain eukaryotes.

5 (*c*) In the five kingdom classification, *Chlamydomonas* and *Chlorella* have been included in kingdom–Protista as they are autotrophic, eukaryotic organisms with cell wall.

6 (*b*) Cyanobacteria are prokaryotes. In five kingdom system of classification (by RH Whittaker), all prokaryotes are included in the kingdom–Monera.

8 (*b*) The given figures

A represents spherical-shaped bacteria generally called as cocci.

B represents the rod-shaped bacteria generally called as bacilli.

C represents the spiral-shaped bacteria (with flagella ranging from one to multiple) generally called as spirilla.

D represents the comma-shaped bacteria called as vibrio.

9 (*c*) Archaebacteria are a primitive group of bacteria. These bacteria can survive in extreme habitats such as marshes, hot springs, deserts, snow, etc.

Archaebacteria have a unique cell wall structure and composition which is responsible for their survival in such extreme conditions. Thus, the type of bacteria which corresponds to the features given is archaebacteria.

10 (*c*) Thermoacidophiles belong to archaebacteria and have dual ability to tolerate high temperature as well as high acidity. They often live in hot sulphur springs where the temperature may be as high as 80°C and pH as low as 2.

11 (*a*) Saline bacteria are called halophiles (e.g. *Halobacterium, Halococcus*). It is a group that belongs archaebacteria which can tolerate high salinity and is commonly found in salt rich substrata.

12 (*b*) The primitive prokaryotes are methanogens. Methanogens are present in the gut of several ruminant animals such as cows and buffaloes.

These are responsible for the production of biogas from the dung of ruminants.

16 (*d*) Cyanobacteria contain photosynthetic pigments found in chromatophores, which are the infoldings of the plasma membrane. In these, photosynthesis is carried out.

17 (*d*) Cyanobacteria, also known as Blue-Green Algae (BGA), are most primitive prokaryotic organisms. These are considered to be the most ancient of all the chlorophyll bearing organisms on earth.

18 (*c*) Cyanobacteria are Gram + ve photosynthetic prokaryotes, which perform oxygenic photosynthesis. Their photosynthetic pigments include chlorophyll-*a*, carotenoids and phycobilins.

21 (*b*) Heterocyst is a large sized, pale-coloured, thick-walled cell, specialised for nitrogen-fixation which occurs in terminal, intercalary or lateral position in filamentous cyanobacteria, e.g. *Nostoc* and *Anabaena.*

22 (*a*) The diagram in option (a) is a filamentous blue-green algae (*Nostoc*), which possesses specialised cells called heterocysts.

23 (*d*) The parts labelled in the figure are identified as (A) *Nostoc*, a genus of cyanobacteria capable of nitrogen-fixation, due to the presence of heterocyst (B), in them. C is mucilaginous sheath which increases the water holding capacity of cell.

26 (*b*) The diagram represents a bacterial cell. A represents the cell wall which contains peptidoglycan. B represents the cell membrane.

C represents the genetic material (DNA) present as nucleoid.

Part D indicates the process of binary fission, by which a mature cell divides into two equal daughter cells.

27 (*b*) Chemosynthetic autotrophic bacteria oxidise various inorganic substances such as nitrates, nitrites and ammonia and use the released energy for their ATP production. They play an important role in the recycling of nutrients like nitrogen, phosphorus, iron and sulphur.

28 (*c*) Green sulphur bacteria are anaerobic bacteria. They do not produce oxygen during photosynthesis. Such type of photosynthesis is known as anoxygenic photosynthesis. These bacteria do not use water as a source of reducing power. Instead, hydrogen is obtained from hydrogen sulphide. The entire photosynthetic process of a green sulphur bacteria can be represented by the following reactions

$$\underset{\text{Hydrogen sulphide}}{H_2S} \longrightarrow 2[H] + S$$

$$6CO_2 + 12H_2 \xrightarrow[\text{Enzymes}]{\text{Light}} C_6H_{12}O_6 + 6H_2O$$

29 (*b*) Citrus canker is a disease, which affects citrus plants. It is caused by the bacterium *Xanthomonas citri.*

30 (*c*) *Mycoplasma* is the triple layered smallest living cells. It does not have definite cell wall. It is an anaerobic organism. It cause diseases in plants (little leaf of brinjal) as well as in animals (pleuromorphic pneumonia in man).

31 (*c*) Mycoplasma are classified under kingdom-Monera. There are two major groups of monerans, archaebacteria and eubacteria. Some other groups of monerans are mycoplasma, rickettsiae and actinomycetes. Mycoplasma are the simplest and the smallest free-living prokaryotes.

32 (*a*) Option (a) is not a feature of protists. It can be corrected as

Kingdom–Protista includes all unicellular eukaryotic organisms like diatoms, dinoflagellates, slime moulds, sarcodine, etc. Rest of the options are features of protists.

33 (*b*) Although all single-celled eukaryotes are placed in kingdom–Protista, yet its boundaries are not well-defined.

35 (*a*) All single-celled eukaryotic organisms like chrysophytes (diatoms and desmids), euglenoids *(Euglena)*, dinoflagellates and slime moulds are included in the kingdom–Protista.

36 (*c*) Chrysophytes include diatoms and desmids (golden algae). These belong to the division–Chrysophyta/ Bacillariophyta.

37 (*c*) Diatoms and desmids are found in freshwater as well as in marine environment. These are microscopic and float passively in water currents.

38 (*a*) Chrysophytes are planktons which float passively in water current. Chrysophytes (diatoms) constitute an important producer (first trophic level) in the form of phytoplanktons in aquatic ecosystem. These are the main source of food for aquatic animals.

39 (*b*) The siliceous cell walls of diatoms are indestructible (i.e. do not decay easily). These were collected over millions of years on the sea floors, called diatomite or diatomaceous earth or silica gel.

These deposits may extend for several hundred metres in certain areas. Thus, silica gel is obtained from diatoms.

41 (*d*) Diatomite or diatomaceous earth is used as a cleaning agent in metal polishes, filtration of oil and syrup, etc. It has no role in biogas production.

42 (*c*) In chrysophytes, the cell wall forms two thin overlapping shells, which fit together as in case of a soap box.

These walls are embedded with silica and thus, are indestructible.

43 (*b*) Diatoms are chief producers in the oceans and they contribute 40% of marine primary productivity. They constitute a major group of unicellular eukaryotic microalgae and are among the most common types of phytoplanktons.

44 (*d*) In dinoflagellates, the two flagella are dissimilar (heterodont), one is transverse flagellum and other is longitudinal flagellum. The longitudinal flagellum is narrow, smooth, directed posteriorly and lies in the sulcus.

The transverse flagellum is ribbon-like and lies in annulus. The two types of flagella beat in different directions.

45 (*c*) In dinoflagellates, cells are generally covered by a rigid coat, the theca or lorica of articulated and sculptured plates formed of cellulose. Because of the presence of sculptured plates, these protists are often known as armoured dinoflagellates.

46 (*c*) The given figure is of a dinoflagellate. For these, option (c) is incorrect and can be corrected as

Dinoflagellates have two flagella, one lying longitudinally and other transversally in a furrow between wall plates.

48 (*b*) Some dinoflagellates (e.g. *Gonyaulax catenella*) are poisonous to vertebrates. When they are present in large numbers, they produce a toxin called saxitoxin into the sea water, which kills fishes and other marine animals.

50 (*c*) Plant-like nutrition is present in *Euglena*. In euglenoids, the nutrition is holophytic (photoautotrophic), saprozoic or holozoic. The photoautotrophs or holophytic forms possess chloroplasts with or without pyrenoids. In *Euglena*, photosynthetic pigments include chlorophyll-*a* and chlorophyll-*b*.

51 (*c*) Slime moulds lack chlorophyll and are heterotrophic. These generally, live as saprotrophs except a few, which are parasites on algae, other fungi and flowering plants.

52 (*b*) The free-living thalloid body of the acellular slime moulds is called plasmodium. It is the wall less mass of multinucleate protoplasm, covered by slime.

53 (*b*) Under favourable conditions slime moulds form an aggregation called plasmodium, which may grow and spread over several feet. During unfavourable conditions, the plasmodium differentiates and forms fruiting bodies bearing spores at their tips. These spores are extremely resistant and survive for many years.

54 (*b*) The figure represents a saprophytic protist organism, i.e. slime mould. These occur over dead and decomposed matter engulfing organic matter.

55 (*d*) Ciliates differ from all other protozoans in having two types of nuclei.

These two nuclei are usually of different size, i.e. one is meganucleus and the other is micronucleus. The former controls metabolism whereas the latter is concerned with reproduction, e.g. *Paramecium.*

62 (*a*) *Trypanosoma gambiense* causes gambian sleeping sickness. It was first observed by Forde in 1901. Bruce discovered that the parasite of sleeping sickness is transmitted by tse-tse fly.

63 (*c*) The most characteristic feature of *Paramecium* is the presence of large number of cilia on its entire body surface. *Paramecium* uses these cilia for locomotion and capturing of food.

64 (*d*) Sporozoans include diverse organisms which have an infectious spore-like stage in their life cycle.

66 (*d*) Option (d) contains the incorrectly named and described organism. *Noctiluca* is a colourless dinoflagellate famous for bioluminescence and is called as sea tinkle. Rest are correctly matched.

67 (*a*) The body of a fungus (except yeast) is made up of a number of elongated , tubular filaments known as hyphae. The network of hyphae is called mycelium.

68 (*a*) The cell wall of fungi is composed of chitin, the second most abundant carbohydrate. It is a homopolymer of N-Acetyl Glucosamine (NAG) joined with β 1-4 linkages. NAG is a modification of glucose molecule.

69 (*b*) Option (b) is wrong for fungi and can be corrected as

In fungi, cell wall contains chitin or cellulose along with other polysaccharides, proteins and lipids. Only in some fungi, e.g. *Phytophthora* or other oomycetes a purely cellulosic cell wall is present. Rest of the options are correct.

70 (*a*) Yeasts are unicellular, degenerated, non-mycelial, saprophytic fungi possessing no hyphae. But sometimes, chain of buds is formed during rapid growth, which may give false appearance of a mycelium and is called as pseudomycelium.

71 (*b*) The coenocytic condition of hyphae arises due to continued nuclear division without undergoing cytokinesis which makes the hyphae multinucleate. If the whole mycelium is without septum, the name is called coenocytic.

74 (*c*) The symbiotic association of a fungus with the root of a higher plant is known as mycorrhiza. The fungus is dependent upon the higher plants for shelter and food and in turn fixes phosphorus for the host plant.

75 (*a*) The fungal mycelium of mycorrhiza in soil plays a highly important role in absorbing and transferring inorganic (mineral) ions, especially, phosphorus and nitrogen from the soil to the plant, it is associated with helping in its proper growth.

76 (*d*) In fungi, vegetative reproduction occurs by fragmentation, budding, fission, sclerotia and rhizomorphs but not through protonema. Protonema refers to the earliest stage of life cycle in moss.

77 (*b*) In fungi, asexual reproduction occurs through the formation of spores, e.g. zoospores, sporangiospores, chlamydospores, oidia, conidia, etc. Oospore is a sexual structure.

78 (*d*) Fungi show sexual reproduction by oospores, ascospores and basidiospores. These various spores are produced in distinct sturctures called fruiting bodies.

80 (*a*) Plasmogamy is the first stage of sexual reproduction in which the cytoplasm of two sex cells fuse with each other.

81 (*b*) Karyogamy is the fusion of two compatible nuclei brought together as a result of plasmogamy.

82 (*d*) Only option (d) represents the correct sequence of Class → Mycelium → Fruiting body.

Other options can be corrected as

- Phycomycetes → Aseptate and coenocytic mycelium → Fruiting bodies are not reported

- Ascomycetes → Branched and septate mycelium → Ascocarps
- Basidiomycetes → Branched and septate mycelium → Basidiocarp.

83 (*b*) In some fungi, during sexual reproduction, the cytoplasm of two cells fuses, but the two nuclei per cell do not. This results in the formation of an intervening dikaryon or binucleate condition and the phase is called dikaryophase of fungus.

85 (*d*) The morphology of the mycelium, mode of spore formation and type of fruiting bodies are the basis for the division of the kingdom–Fungi into four classes, i.e.

(i) Phycomycetes (ii) Ascomycetes

(iii) Basidiomycetes (iv) Deuteromycetes

86 (*b*) *Rhizopus* (black bread mould) is included in the class–Phycomycetes. It is the common saprotrophic fungi that attack a variety of food stuffs.

87 (*c*) Coenocytic, multinucleate and aseptate mycelium is found in class–Phycomycetes, e.g. *Albugo*.

89 (*c*) In Phycomycetes asexual reproduction occurs through motile zoospores or through non-motile aplanospores, endogenously produced in the respective sporangium.

92 (*d*) *Agaricus* belongs to the class–Basidiomycetes. *Agaricus* is a genus of mushrooms containing both edible and poisonous species. Rest all belong to the Phycomycetes.

93 (*b*) The mycelium of the *Rhizopus* is distinguishable into three types of hyphae namely, rhizoidal hyphae, stolons and sporangiophores. The mycelium is aseptate, branched and multinucleate (coenocytic).

94 (*b*) Ascomycetes are commonly known as sac fungi, due to their sac-like appendage which holds the spores.

95 (*b*) Ascomycetes can be unicellular, e.g. yeast or multicellular, e.g. *Penicillium*.

96 (*d*) Members of Ascomycetes are saprophytic, decomposers, parasitic or coprophilous (growing on dung).

98 (*a*) *Neurospora* is widely used in genetics as a model organism because it reproduces quickly, is easy to culture and can survive on minimal media.

99 (*b*) Morels and truffles differ widely in their form and behaviour. The morels resemble mushrooms to the extent that they have a cap borne upon a central stem, while the truffles form solid, round balls, which grow underground. These are the edible Ascomycetes members. Both morels and truffles, represent some of the most highly priced edible mushrooms in the world.

102 (*b*) The class–Basidiomycetes include those members that produce their basidia and basidiospores on or in a basidiocarp. In Basidiomycetes, the mycelium is branched and septate.

103 (*d*) In Basidiomycetes, vegetative reproduction takes place by fragmentation. It is a form of asexual reproduction, where a new organism grows from a fragment of the parent.

104 (*d*) Basidiomycetes includes not only mushrooms, toad stools, puffballs, jelly fungi and shelf fungi, but also many important plant pathogens, like rusts and smuts. All these fungi bear characteristic fruiting bodies called basidiocarps.

105 (*d*) The *Alternaria* sp., are imperfect filamentous fungi belonging to the class–Deuteromycetes.

106 (*a*) *Ustilago* and *Puccinia* are the common parasites included in Basidiomycetes. *Puccinia graminis tritici* causes black rust of wheat, while *Ustilago* causes destructive smut diseases in most of the cereal plants.

107 (*a*) In Deuteromycetes, the mycelium is septate and branched. Coenocytic forms are not known in Deuteromycetes.

108 (*a*) The imperfecti fungi, which are decomposers of litter and help in mineral cycling belong to the class Deuteromycetes.

They are fungi, which do not fit into the commonly established taxonomic classification of fungi. They include all those fungi in which the perfect stage (sexual stage) is not reported.

109 (*a*) Deuteromycetes reproduce only by asexual spores known as conidia. These are non-motile fungal mitospores, which are produced exogenously from the tips and sides of the hyphae called conidiophores.

112 (*b*) Option (b) is the correct match. Rest of incorrect matches can be corrected as

(i) *Phytophthora* belongs to Phycomycetes (algal fungi). They contain either unicellular thallus or non-septate coenocytic mycelium.

They are mostly plant damaging oomycetes (water molds).

(iii) *Mucor* also belong to Phycomycetes. They have mycelium which is coenocytic (multinucleate) and profusely branched. They reproduce vegetatively *via* conjugation.

(iv) *Agaricus* belongs to Basidiomycetes (where karyogamy and meiosis occur). They contain well-developed filaments, branched and septate mycelium. They are saprophytic, but not parasitic.

113 (*a*) Option (a) contains the incorrect match and can be corrected as

Morels and truffles are belong to class–Ascomycetes. Rest of the matches are correct.

114 (*b*) In plants, nutrition is typically autotrophic. A few plants, such as *Drocera* and *Nepenthes*, are insectivorous to get additional nitrogen and hence are partially heterotrophic.

115 (*d*) Insectivorous plants can capture and digest live prey, to obtain nitrogen compounds that are lacking in their usual marshy habitat, e.g. bladderwort, Venus flytrap, *Nepenthes*.

116 (*a*) *Cuscuta* is a parasitic plant. It has no chlorophyll and cannot make its own food by photosynthesis. Instead, it grows on other plants using their nutrients for its growth.

117 (*c*) Plants show alternation of generation, i.e. life cycle of plants has two distinct phase, the haploid gametophytic and diploid sporophytic that alternate with each other.

120 (*d*) The kingdom–Animalia includes sponges, corals, worms, insects, snails, starfishes, bony fishes, frogs, lizards, snakes, crocodiles, birds and mammals.

These organisms are heterotrophic, multicellular, eukaryotes without chlorophyll. Heterotrophic organisms cannot synthesise their own food.

121 (*a*) Glycogen is the storage form of carbohydrates in animals and humans. Glycogen is synthesised and stored mainly in the liver and the muscles in body. Excess amount of glucose in blood is converted into fat. Hence, glycogen is the reserve food material in animals.

122 (*d*) Option (d) is not a feature of the animal kingdom. Kingdom–Animalia consists of achlorophyllous organisms. Members of kingdom–Plantae are chlorophyllous.

125 (*d*) Viruses and viroids are the non-cellular organisms, which are not characterised or classified under any of the classes described by Whittaker.

126 (*c*) Viruses are considered as living or alive by some biologists because they have the capability to utilise the host cell machinery for multiplying their numbers or reproducing. In the process, they affect the normal stable condition of their host (i.e. they cause disease).

127 (*b*) The tobacco mosaic virus is a long, slender and rod-shaped. It is a complex structure made up of nucleoprotein (the protein and nucleic acid). The central core of ribonucleic acid is surrounded by virus protein.

129 (*c*) The genetic material of viruses could be either RNA or DNA (both *ds* and *ss*). No virus contains both RNA and DNA. In general, viruses that infects plants have *ss*RNA and viruses that infect animals have either single or double-stranded RNA or *ds* DNA.

132 (*a*) Viruses are also known as nucleoprotein particles. The nucleic acid of virus is surrounded by a protein shell called capsid.

133 (*d*) The latest view for the origin of virus is that many scientists believe that viruses are modified plasmids, which are the fragments of the nucleic acids of the host. Their genome fractions escaped and got inducted into new host cells.

135 (*d*) Viruses are known as the connecting link between non-living and living beings. They are thought to be non-living as they do not show any sign of life outside the host and are able to get crystallised.

136 (*a*) In humans, viruses cause various diseases like AIDS (HIV virus), mumps (paramyxovirus), smallpox (variola virus), herpes (HSVI) and influenza (RNA viruses of the family–Orthomyxoviridae). Thus, option (a) depicts the correct group of viral diseases.

138 (*d*) Cauliflower mosaic virus is one of only a few double-stranded DNA plant viruses.

139 (*b*) Bacteriophage is a virus that infects and replicates within a bacteria. Bacteriophages are composed of proteins that encapsulate a DNA or RNA genome and may have relatively simple or elaborated structure.

141 (*b*) Viroids were discovered by TO Diener in 1971 as a new infectious agents which were smaller than viruses. Viroids lack capsid and does not have proteins associated with them.

142 (*d*) Viroids differ from viruses in having RNA molecules without protein coat. Viruses on the other hand posses DNA or RNA with a protein coat as their genetic material.

Viruses can infect a wide range of organisms including plants, animals or bacteria, while viroids infect only plants.

143 (*b*) Lichen is a structurally organised entity consisting of a permanent association of a fungus and an alga. The fungal component of a lichen is called mycobiont and the algal component is called phycobiont.

144 (*d*) The fungal partner protects the alga by retaining water. It provides a large surface area for the absorption of mineral nutrients and also helps in anchorage.

145 (*a*) The algal or cyanobacterial cells are photosynthetic and possess the green pigment, chlorophyll enabling them to use sunlight's energy to make their own food from water and CO_2 through photosynthesis. They also provide vitamins to the fungus.

146 (*a*) Lichens are useful bioindicators for air pollution, especially sulphur dioxide pollution, since they derive their water and essential nutrients mainly from the atmosphere rather than from soil.

147 (*d*) In primary succession on rocks, lichens secrete acids to dissolve rock, help in weathering and soil formation. Thus, lichens are pioneer species to colonise the bare rock.

148 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The two kingdom system of classification was used till very recently. This system did not distinguish between the eukaryotes and prokaryotes, unicellular and multicellular organisms and photosynthetic (green algae) and non-photosynthetic (fungi) organisms. Classification of organisms into plants and animals was easily done and was easy to understand, inspite of the fact that, a large number of organisms did not fall into either category. Hence, the two kindgom classification, was found to be inadequate.

149 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

Five kingdom classification has proposed by RH Whittaker. The classification differentiated between the heterotrophic group, fungi and the autotrophic green plants, as they showed a characteristic difference in their wall composition–the fungi had chitin, while the green plants had cellulose in their cell walls. Thus, he placed them in separate kingdoms.

150 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

Euglena is a green-coloured, single-celled organism, which moves like animals . Some taxonomists

considered it as a plant and included it in the plant kingdom on the basis of the presence of chlorophyll, while others, included it in the animal kingdom along with the flagellated protozoans because of the occurrence of locomotion by flagella. It was classified as a protist later by RH Whittaker in his five kingdom classification.

151 (*c*) Assertion is true, but Reason is false. Reason can be corrected as

Fungi are wide spread in distribution. These may be epiphytic, saprophytic, symbiotic and parasitic. Fungi lack chlorophyll pigments and hence do not have autotrophic mode of nutrition. These are heterotrophs.

152 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

In fungi, there is gradual and progressive simplification and ultimate elimination of the sexual apparatus from the lower to higher forms of fungi. In case of algae, the sexual apparatus increases in complexity from simple to higher forms.

153 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Viruses are active only when they are inside the living host cells as viruses do not possess any replicating property and require a host to replicate its genetic material. Outside the host, they are as good as chemical substances.

154 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Polluted water bodies have high abundance of *Nostoc* and *Oscillatoria*. This is because cyanobacteria or blue-green bacteria such as *Nostoc* and *Oscillatoria* can tolerate adverse conditions due to the presence of mucilage covering, resistant proteins and the absence of sap vacoules.

155 (*c*) Assertion is true, but Reason is false. Reason can be corrected as

Slime moulds are called as fungus like animals because they possess characters of both the animals and fungi. Their spores possess a true cell wall.

156 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Kingdom–Plantae consists of autotrophic organisms, i.e. those which are capable of manufacturing their own food. Thus, all the members contain chlorophyll and are eukaryotic.

However, certain insectivores additionally depend on insect for meeting their nitrogen requirement. Such plants are called insectivorous and are partially heterotrophic.

157 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Three domain system or six kingdom system of classification is a biological system of classification which divides organisms based on cellular characteristics. The three domains are, archaea (primitive prokaryotes), bacteria and eukarya (eukaryotic organisms originating from endosymbiotic association between archaebacteria and eubacteria, i.e. Protista, Fungi, Plantae and Animalia).

159 (*c*) The statement in option (c) is incorrect and can be corrected as

Chlorella and *Chlamydomonas* both have cell walls.

Rest statements are correct.

160 (*c*) The statement in option (c) is incorrect and can be corrected as

Bacteria occur almost everywhere. They have a very simple structure, but a very complex behaviour. Rest of the statements are correct.

162 (*c*) The statement in option (c) is incorrect about methanogens and can be corrected as

The bacteria, which grow anaerobically, on cellulosic material and produce large amount of methane along with CO_2 and H_2 are collectively called as methanogens. Rest of the statements are correct.

163 (*b*) The statement in option (b) is correct. All archaebacteria share certain key characteristics like

(i) Their cell wall lacks peptidoglycans (important component of cell wall of eubacteria).

(ii) Archaebacteria have distinct ribosomal RNA sequence.

(iii) Some genes of archaebacteria possess introns, unlike other bacteria.

Rest of the statements are incorrect and can be corrected as

Archaea neither completely resembles prokarya and eukarya nor it completely differs from them.

164 (*a*) The statement in option (a) is incorrect and can be corrected as

Binary fission is the common method of bacterial multiplication under favourable conditions. In this method, a mature bacterial cell divides equally form two daughter cells. They show sexual reproduction also.

Rest of the statements are correct.

165 (*b*) The statement in option (b) is incorrect and can be corrected as

Eubacteria are also called true bacteria.

Rest of the statements are correct.

166 (*a*) The statement in option (a) is correct. Rest of the statements are incorrect and can be corrected as

Influenza and herpes are caused by virus having RNA and DNA, respectively.

Nostoc and *Anabaena* are examples of free-living nitrogen-fixers.

Methanogens are methane producing bacteria found in marshy areas and paddy fields not in wheat crops.

167 (*b*) The statement in option (b) is incorrect and can be corrected as

Fimbriae and pili are fine hair-like appendages used by bacteria for attachment rather than motility.

Rest of the statements are correct.

168 (*c*) The statement in option (c) is incorrect about mycoplasma and can be corrected as

They can survive without oxygen.

Rest of the statements are correct.

169 (*a*) The statement in option (a) is incorrect and can be corrected as

Diatoms are single-celled, plant-like protists that produce intricately structured cell walls made up of silica (SiO_2). Thus, their walls are indestructible.
Rest of the statements are correct.

170 (*a*) The statement in option (a) is correct about euglenoid. Rest of the statements are incorrect and can be corrected as

Euglenoids occur in freshwater habitats.

They contain the photosynthetic pigments, chlorophyll-*a* and chlorophyll-*b* like plants.

Euglena when placed in continuous darkness, behaves, as heterotroph by predating on other smaller organisms to survive.

171 (*d*) The statement in option (d) is incorrect and can be corrected as

Desmids are mainly found in freshwater and are usually indication of clean (unpolluted) water.
Rest of the statements are correct.

173 (*b*) The statement in option (b) is correct. Rest of the statements are incorrect and can be corrected as

- Slime moulds are diploid, e.g. *Physarum*.
- Dinoflagellates are motile, e.g. *Noctiluca*, *Peridinium*, etc.
- The body of *Euglena* is covered with pellicle.

174 (*c*) The statement in option (c) is incorrect and can be corrected as

In Ascomycetes, the mycelium is well-developed and branched. The hyphae are septate and multicellular.
Rest of the statements are correct.

175 (*c*) The statement in option (c) is incorrect and it can be corrected as

Yeast is a unicellular sac fungus which lacks filamentous structures or hyphae. However, they may form short temporary filamentous structure called pseudomycelium.

Rest of the statements are correct.

176 (*a*) The statement in option (a) is correct.

Rest of the statements are incorrect and can be corrected as

- Algal component of lichens is called phycobiont.
- Fungal component of lichens is called mycobiont.
- Lichens are good pollution indicators. Thus, their population reduces in highly polluted area.

179 (*a*) The statement in option (a) is incorrect about plants. It can be corrected as

Plants are autotrophic and make their own food through photosynthesis. Rest other statements are correct.

180 (*b*) The statement in option (b) is incorrect and can be corrected as

The infective constituent in virus is their genetic material, i.e. either DNA or RNA and not protein. They take over the biosynthetic machinery of the host cell and produce chemicals required for their own multiplication. Rest of the statements are correct.

181 (*a*) The statement in option (a) is incorrect and can be corrected as

Viroids were discovered by TO Diener in 1971 as a new infectious agent that was smaller than virus.
Rest of the statements are correct.

183 (*b*) Statements I and III are correct. Statement II is incorrect and can be corrected as

Archaebacteria are characterised by the absence of peptidoglycan in their wall. Instead, their cell wall contains proteins and non-cellulosic polysaccharides.

187 (*b*) The statements given correspond to slime moulds. Slime moulds are saprophytic protists. In slime moulds, spores possess true walls. The spores are dispersed by air. They are extremely resistant and survive for many years even under adverse conditions.

189 (*b*) Statements I, II, III and VI are correct. Statements IV and V are incorrect and can be corrected as

- Some unicellular fungi like yeast, are used to make bread and beer. *Ustilago* is responsible for smut disease.
- *Puccinia graminis tritici* is responsible for black rust of wheat.

195 (*b*) Statements I and III are correct. Statement II is incorrect and can be corrected as

Kingdom–Plantae includes algae, bryophytes, pteridophytes, gymnosperms and angiosperms.

198 (c) Statement II is correct about virus. Statements I, III and IV are incorrect and can be corrected as

Viruses are obligate parasites and cannot be cultured on an arificial medium. If a mixture of viruses and bacteria is filtered through a bacterial proof filter, the viruses will pass through into the filtrate in the flask as they are smaller than bacteria. Viruses are made up of proteins and DNA or RNA.

200 (*a*) Statement I is true, but II is false and it can be corrected as

Bacterial viruses or Bacteriophages have commonly double-stranded DNA, but all the other genome types can also occur in them.

217 (*b*) The statement in option (b) is incorrect and it can be corrected as

The kindgom–Plantae includes eukaryotic, mainly multicellular photosynthetic organisms.

Rest of the statements are correct.

218 (*b*) Protista is the group of containing unicellular eukaryotic plants and animals. The organisms included in this group are either photoautotrophs, heterotrophs or parasites.

219 (*d*) Slime moulds are saprophytic protists, which move along the dead leaves and engulf organic material. These are multinucleated and do not possess cell wall and have naked cytoplasm.

220 (*a*) The difference between a virus and a viroid is that a virus contains DNA or RNA as genetic material and a protein coat, whereas viroids have no protein coat and contain only RNA as their nucleic acid.

221 (*d*) In the five kingdom system of classification of Whittaker, non-cellular organisms like viruses and viroids are not mentioned. Viruses did not find a place in any system of classification since, they are non-cellular and not truly 'living'.

222 (*c*) Mycorrhiza is the symbiotic association between a fungus and the roots of a higher plants like gymnosperms and angiosperms.

Whereas lichens are the symbiotic association between algae and fungi. Ferns are group of plants, belong to pteridophytes like other vascular plants and BGA is blue-green algae with a prokaryotic cell.

223 (*a*) RH Whittaker (1969) an American taxonomist in order to develop phylogenetic classification divided organisms into five kingdoms, i.e.

(i) Monera (ii) Protista
(iii) Fungi (iv) Plantae
(v) Animalia

Thus, RH Whittaker proposed the five kingdom system of classification.

- Whereas, C Linnaeus developed two kingdom system of classification, i.e.
  (i) kingdom–Plantae
  (ii) kingdom–Animalia
- Virchow is associated with the discovery of cell theory.

224 (*b*) **Halophiles** are organisms that live in areas of high concentration of salts. The name halophiles is originated from the greek word that means 'salt loving'.

Heliophytes are the plants that grow best in sunlight and cannot survive in salty conditions.

Methanogens are the bacteria that produces methane as a metabolic byproducts in anaerobic conditions.

Thermoacidophiles are archaebacteria striving under strong acidic environments and high temperatures, but cannot tolerate high salt concentrations around them.

225 (*b*) **MW Beijerinck** proposed *contagium vivum fluidum* means contagious living fluid. This phrase was first used to describe virus, characteristic in escaping from the finest mesh available.

DJ Ivanowsky was a Russian botanist who discovered the filterable nature of viruses and one of the founder of virology.

Stanley Miller was a Jewish American chemist experimented on origin of life.

Robert Hooke was the first to study and record cells using his primitive microscope.

226 (*b*) Dikaryon is a cell containing two nucleus. This results when two somatic cells fuse, but their nucleus does not fuse immediately. These are found in Basidiomycetes.

227 (*c*) **Lichens** are dual organisms, which has a permanent symbiotic association of fungus and an alga. The fungal partner is called mycobiont and the algal partner is called phycobiont.

Mycorrhiza is association of fungus with roots, but not with an algae, while BGA or blue-green alga is a member of Monera having a prokaryotic cell.

228 (*c*) Plasmogamy means fusion of protoplasm and karyogamy means fusion of nucleus. These two events lead to the formation of zygote (*2n*) which is a diploid structure where meiosis takes place. Thus, option (c) gives the correct sequence of events with respect to fungal sexual cycle.

229 (*d*) Phycomycetes are the members of fungi that can thrive well on dead and decaying wood as saprophytes. These prefer to live in moist and damp places and need water for the movement of zoospores and sexual gametes.

Few members of Phycomycetes are obligate parasites like *Phytophthora infestans* causing late blight of potato and *Peronospora viticola* causing downy mildew of grapes.

Thus, Phycomycetes are found in aquatic habitats, on decaying wood, in moist and damp places and also as obligate parasite, on plants.