Chapter 2
Biological Classification

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

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

3. 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?
(a) *Pseudomonas* (b) Mycoplasma
(c) *Nostoc* (d) *Bacillus*
(NEET 2017)

4. Which of the following components provides sticky character to the bacterial cell?
(a) Nuclear membrane
(b) Plasma membrane
(c) Glycocalyx
(d) Cell wall
(NEET 2017)

5. DNA replication in bacteria occurs
(a) within nucleolus
(b) prior to fission
(c) just before transcription
(d) during S phase. *(NEET 2017)*

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

7. Methanogens belong to
(a) eubacteria (b) archaebacteria
(c) dinoflagellates (d) slime moulds.
(NEET-II 2016)

8. Select the wrong statement.
(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. *(NEET-II 2016)*

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

10. Which one of the following statements is wrong?
(a) Eubacteria are also called false bacteria.
(b) Phycomycetes are also called algal fungi.
(c) Cyanobacteria are also called blue-green algae.
(d) Golden algae are also called desmids.
(NEET-I 2016)

11. Which of the following statements is wrong for viroids?
(a) They cause infections.
(b) Their RNA is of high molecular weight.
(c) They lack a protein coat.
(d) They are smaller than viruses.
(NEET-I 2016)

12. One of the major components of cell wall of most fungi is
(a) cellulose (b) hemicellulose
(c) chitin (d) peptidoglycan.
(NEET-I 2016)

13. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the Kingdom
(a) Fungi (b) Animalia
(c) Monera (d) Protista.
(NEET-I 2016)

14. Which one is a wrong statement?
(a) Haploid endosperm is typical feature of Gymnosperms.
(b) Brown algae have chlorophyll *a* and *c* and fucoxanthin.
(c) Archegonia are found in Bryophyta, Pteridophyta and Gymnosperms.
(d) *Mucor* has biflagellate zoospores.
(2015)

15. The imperfect fungi which are decomposers of litter and help in mineral cycling belong to
(a) Phycomycetes (b) Ascomycetes
(c) Deuteromycetes (d) Basidiomycetes.
(2015)

16. The structures that help some bacteria to attach to rocks and/or host tissues are
(a) mesosomes (b) holdfast
(c) rhizoids (d) fimbriae.
(2015)

17. Select the wrong statement.
(a) The term '*contagium vivum fluidum*' was coined by M. W. Beijerinck.
(b) Mosaic disease in tobacco and AIDS in human being are caused by viruses.
(c) The viroids were discovered by D.J. Ivanowsky.
(d) W.M. Stanley showed that viruses could be crystallised. *(2015)*

18. In which group of organisms the cell walls form two thin overlapping shells which fit together?
(a) Dinoflagellates (b) Slime moulds
(c) Chrysophytes (d) Euglenoids
(2015)

19. Pick up the wrong statement.
(a) Some fungi are edible.
(b) Nuclear membrane is present in Monera.
(c) Cell wall is absent in Animalia.
(d) Protists have photosynthetic and heterotrophic modes of nutrition.
(2015)

20. Choose the wrong statement.
(a) Morels and truffles are poisonous mushrooms.
(b) Yeast is unicellular and useful in fermentation.
(c) *Penicillium* is multicellular and produces antibiotics.
(d) *Neurospora* is used in the study of biochemical genetics.
(2015)

21. Cell wall is absent in
(a) Mycoplasma (b) *Nostoc*
(c) *Aspergillus* (d) *Funaria*.
(2015)

22. True nucleus is absent in
(a) *Vaucheria* (b) *Volvox*
(c) *Anabaena* (d) *Mucor*.
(2015 Cancelled)

23. Which one of the following matches is correct?

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

(2015 Cancelled)

24. Five kingdom system of classification suggested by R.H. Whittaker is not based on
(a) presence or absence of a well defined nucleus
(b) mode of reproduction
(c) mode of nutrition
(d) complexity of body organisation.
(2014)

25. Which of the following shows coiled RNA strand and capsomeres?
(a) Polio virus
(b) Tobacco mosaic virus
(c) Measles virus
(d) Retrovirus *(2014)*

26. Viruses have
(a) DNA enclosed in a protein coat
(b) prokaryotic nucleus
(c) single chromosome
(d) both DNA and RNA. *(2014)*

27. Archaebacteria differ from eubacteria in
(a) cell membrane structure
(b) mode of nutrition
(c) cell shape
(d) mode of reproduction. *(2014)*

28. Which structures perform the function of mitochondria in bacteria?
(a) Nucleoid (b) Ribosomes
(c) Cell wall (d) Mesosomes
(2014)

29. The motile bacteria are able to move by
(a) fimbriae (b) flagella
(c) cilia (d) pili.
(2014)

30. Anoxygenic photosynthesis is characteristic of
(a) *Rhodospirillum* (b) *Spirogyra*
(c) *Chlamydomonas* (d) *Ulva.*
(2014)

31. Which of the following are likely to be present in deep sea water?
(a) Blue-green algae (b) Saprophytic fungi
(c) Archaebacteria (d) Eubacteria
(NEET 2013)

32. Pigment containing membranous extensions in some cyanobacteria are
(a) pneumatophores (b) chromatophores
(c) heterocysts (d) basal bodies.
(NEET 2013)

33. Why is a capsule advantageous to a bacterium?
(a) It protects the bacterium from desiccation.
(b) It provides means of locomotion.
(c) It allows bacterium to "hide" from host's immune system.
(d) It allows the bacterium to attach to the surface.
(Karnataka NEET 2013)

34. Which one of the following is true for fungi?
(a) They lack a rigid cell wall.
(b) They are heterotrophs.
(c) They lack nuclear membrane.
(d) They are phagotrophs.
(Karnataka NEET 2013)

35. Which statement is wrong for viruses?
(a) All are parasites.
(b) All of them have helical symmetry.
(c) They have ability to synthesize nucleic acids and proteins.
(d) Antibiotics have no effect on them.
(2012)

36. Maximum nutritional diversity is found in the group
(a) fungi (b) animalia
(c) monera (d) plantae.
(2012)

37. Nuclear membrane is absent in
(a) *Penicillium* (b) *Agaricus*
(c) *Volvox* (d) *Nostoc.*
(2012)

38. The cyanobacteria are also referred to as
(a) protists (b) golden algae
(c) slime moulds (d) blue green algae.
(2012)

39. The most abundant prokaryotes helpful to humans in making curd from milk and in production of antibiotics are the ones categorised as
(a) cyanobacteria
(b) archaebacteria
(c) chemosynthetic autotrophs
(d) heterotrophic bacteria. *(2012)*

40. Which one single organism or the pair of organisms is correctly assigned to its or their named taxonomic group?
(a) *Paramecium* and *Plasmodium* belong to the same kingdom as that of *Penicillium*.
(b) Lichen is a composite organism formed from the symbiotic association of an algae and a protozoan.
(c) Yeast used in making bread and beer is a fungus.
(d) *Nostoc* and *Anabaena* are examples of protista. *(2012)*

41. Which one of the following microbes forms symbiotic association with plants and helps them in their nutrition?
(a) *Azotobacter* (b) *Aspergillus*
(c) *Glomus* (d) *Trichoderma*
(2012)

42. In the five kingdom classification, *Chlamydomonas* and *Chlorella* have been included in

(a) protista (b) algae
(c) plantae (d) monera.
(Mains 2012)

43. Which one of the following also acts as a catalyst in a bacterial cell?
(a) 5S *r*RNA (b) snRNA
(c) hnRNA (d) 23S *r*RNA
(2011)

44. In eubacteria, a cellular component that resembles eukaryotic cell is
(a) plasma membrane (b) nucleus
(c) ribosomes (d) cell wall.
(2011)

45. Which one of the following organisms is not an eukaryote?
(a) *Paramecium caudatum*
(b) *Escherichia coli*
(c) *Euglena viridis*
(d) *Amoeba proteus* *(2011)*

46. Which one of the following is incorrectly matched?
(a) Root pressure-guttation
(b) *Puccinia*-smut
(c) Root-exarch protoxylem
(d) *Cassia*-imbricate aestivation
(2011)

47. The pathogen *Microsporum* responsible for ringworm disease in humans belongs to the same kingdom of organisms as that of
(a) *Taenia*, a tapeworm
(b) *Wuchereria*, a filarial worm
(c) *Rhizopus*, a mould
(d) *Ascaris*, a round worm. *(Mains 2011)*

48. Virus envelope is known as
(a) capsid (b) virion
(c) nucleoprotein (d) core.
(2010)

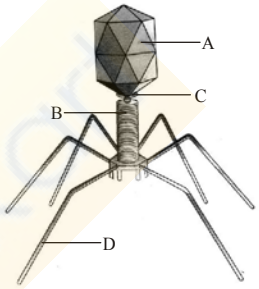
49. Single-celled eukaryotes are included in
(a) protista (b) fungi
(c) archaea (d) monera.
(2010)

50. Some hyperthermophilic organisms that grow in highly acidic (pH 2) habitats belong to the two groups
(a) eubacteria and archaea
(b) cyanobacteria and diatoms
(c) protists and mosses
(d) liverworts and yeasts. *(2010)*

51. One of the free-living, anaerobic nitrogen-fixer is
(a) *Beijernickia* (b) *Rhodospirillum*
(c) *Rhizobium* (d) *Azotobacter*.
(2010)

52. Membrane-bound organelles are absent in
(a) *Saccharomyces* (b) *Streptococcus*
(c) *Chlamydomonas* (d) *Plasmodium*.
(2010)

53. Give below is the diagram of a bacteriophage. In which one of the options all the four parts A, B, C and D are correct?



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

(Mains 2010)

54. Select the correct combination of the statements (i-iv) regarding the characteristics of certain organisms.
(i) Methanogens are archaebacteria which produce methane in marshy areas.
(ii) *Nostoc* is a filamentous blue-green alga which fixes atmospheric nitrogen.
(iii) Chemosynthetic autotrophic bacteria synthesize cellulose from glucose.
(iv) Mycoplasma lack a cell wall and can survive without oxygen.
The correct statements are
(a) (ii) and (iii) (b) (i),(ii) and (iii)
(c) (ii), (iii) and (iv) (d) (i), (ii) and (iv).
(Mains 2010)

55. Black (stem) rust of wheat is caused by
(a) *Alternaria solani*
(b) *Ustilago nuda*
(c) *Puccinia graminis*
(d) *Xanthomonas oryzae.* *(Mains 2010)*

56. Phylogenetic system of classification is based on
(a) morphological features
(b) chemical constituents
(c) floral characters
(d) evolutionary relationships.
(2009)

57. T.O. Diener discovered a
(a) free infectious DNA
(b) infectious protein
(c) bacteriophage
(d) free infectious RNA. *(2009)*

58. Oxygenic photosynthesis occurs in
(a) *Oscillatoria* (b) *Rhodospirillum*
(c) *Chlorobium* (d) *Chromatium*.
(2009)

59. Which of the following is a symbiotic nitrogen fixer?
(a) *Azotobacter* (b) *Frankia*
(c) *Azolla* (d) *Glomus*
(2009)

60. Which one is the wrong pairing for the disease and its causal organism?
(a) Black rust of wheat-*Puccinia graminis*
(b) Loose smut of wheat-*Ustilago nuda*
(c) Root knot of vegetables-*Meloidogyne* sp.
(d) Late blight of potato-*Alternaria solani*
(2009)

61. Bacterial leaf blight of rice is caused by a species
(a) *Alternaria* (b) *Erwinia*
(c) *Xanthomonas* (d) *Pseudomonas*.
(2008)

62. *Thermococcus*, *Methanococcus* and *Methanobacterium* exemplify
(a) bacteria whose DNA is relaxed or positively supercoiled but which have a cytoskeleton as well as mitochondria
(b) bacteria that contain a cytoskeleton and ribosomes
(c) archaebacteria that contain protein homologous to eukaryotic core histones
(d) archaebacteria that lack any histones resembling those found in eukaryotes but whose DNA is negatively supercoiled.
(2008)

63. In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements in true about archaea?
(a) Archaea completely differ from both prokaryotes and eukaryotes.
(b) Archaea completely differ from prokaryotes.
(c) Archaea resemble eukarya in all respects.
(d) Archaea have some novel features that are absent in other prokaryotes and eukaryotes. *(2008)*

64. Which one of the following is a slime mould?
(a) *Physarum* (b) *Thiobacillus*
(c) *Anabaena* (d) *Rhizopus (2007)*

65. Which one of the following statements about mycoplasma is wrong?
(a) They are pleomorphic.
(b) They are sensitive to penicillin.
(c) They cause diseases in plants.
(d) They are also called PPLO. *(2007)*

66. Which pair of the following belongs to basidiomycetes?
(a) Puffballs and *Claviceps*
(b) *Peziza* and stink horns
(c) *Morchella* and mushrooms
(d) Birds nest fungi and puffballs *(2007)*

67. Curing of tea leaves is brought about by the activity of
(a) fungi (b) bacteria
(c) mycorrhiza (d) viruses. *(2006)*

68. Which of the following environmental conditions are essential for optimum growth of *Mucor* on a piece of bread ?
A. Temperature of about 25° C
B. Temperature of about 5° C
C. Relative humidity of about 5%
D. Relative humidity of about 95%
E. A shady place
F. A brightly illuminated place
Choose the answer from the following options.
(a) B, C and F only (b) A, C and E only
(c) A, D and E only (d) B, D and E only
(2006)

69. All of the following statements concerning the actinomycetous filamentous soil bacterium *Frankia* are correct except that *Frankia*
(a) can induce root nodules on many plant species
(b) can fix nitrogen in the free-living state
(c) cannot fix specialized vesicles in which the nitrogenase is protected from oxygen by a chemical barrier involving triterpene hopanoids

(d) like *Rhizobium*, it usually infects its host plant through root hair deformation and stimulates cell proliferation in the host's cortex. *(2005)*

70. For retting of jute the fermenting microbe used is
(a) methanophilic bacteria
(b) butyric acid bacteria
(c) *Helicobactor pylori*
(d) *Streptococcus lactin*. *(2005)*

71. Basophilic prokaryotes
(a) grow and multiply in very deep marine sediments
(b) occur in water containing high concentrations of barium hydroxide
(c) readily grow and divide in sea water enriched in any soluble salt of barium
(d) grow slowly in highly alkaline frozen lakes at high altitudes. *(2005)*

72. There exists a close association between the alga and the fungus within a lichen. The fungus
(a) provides protection, anchorage and absorption for the algae
(b) provides food for the alga
(c) fixes the atmospheric nitrogen for the alga
(d) releases oxygen for the alga. *(2005)*

73. Which of the following statements is *not* true for retroviruses?
(a) DNA is not present at any stage in the life cycle of retroviruses.
(b) Retroviruses carry gene for RNA-dependent DNA polymerase.
(c) The genetic material in mature retroviruses is RNA.
(d) Retroviruses are causative agents for certain kinds of cancer in man. *(2004)*

74. Viruses that infect bacteria multiply and cause their lysis, are called
(a) lysozymes (b) lipolytic
(c) lytic (d) lysogenic.
(2004)

75. Phenetic classification of organisms is based on
(a) observable characteristics of existing organisms
(b) the ancestral lineage of existing organisms
(c) dendrogram based on DNA characteristics
(d) sexual characteristics. *(2004,2003)*

76. A free living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water fern *Azolla* is
(a) *Tolypothrix* (b) *Chlorella*
(c) *Nostoc* (d) *Anabaena*.
(2004)

77. During replication of a bacterial chromosome DNA synthesis starts from a replication origin site and
(a) RNA primers are involved
(b) is facilitated by telomerase
(c) moves in one direction of the site
(d) moves in bi-directional way. *(2004)*

78. Lichens are well known combination of an alga and a fungus where fungus has
(a) a saprophytic relationship with the alga
(b) an epiphytic relationship with the alga
(c) a parasitic relationship with alga
(d) a symbiotic relationship with alga.
(2004)

79. Chromosomes in a bacterial cell can be 1 – 3 in number and
(a) are always circular
(b) are always linear
(c) can be either circular or linear, but never both within the same cell
(d) can be circular as well as linear within the same cell. *(2003)*

80. Which one of the following statements about viruses is correct ?
(a) Viruses possess their own metabolic system.
(b) All viruses contain both RNA and DNA.
(c) Viruses are obligate parasites.
(d) Nucleic acid of viruses is known as capsid.
(2003)

81. Tobacco mosaic virus is a tubular filament of size
(a) 300 × 10 nm (b) 300 × 5 nm
(c) 300 × 20 nm (d) 700 × 30 nm.
(2003)

82. Viruses are no more "alive" than isolated chromosomes because
(a) they require both RNA and DNA
(b) they both need food molecules
(c) they both require oxygen for respiration
(d) both require the environment of a cell to replicate. *(2003)*

83. In which kingdom would you classify the archaea and nitrogen-fixing organisms, if the five-kingdom system of classification is used ?
(a) Plantae (b) Fungi
(c) Protista (d) Monera *(2003)*

84. In five kingdom system, the main basis of classification is
(a) structure of nucleus
(b) mode of nutrition
(c) structure of cell wall
(d) asexual reproduction. *(2002)*

85. Which statement is correct for bacterial transduction?
(a) Transfer of some genes from one bacteria to another bacteria through virus.
(b) Transfer of genes from one bacteria to another bacteria by conjugation.
(c) Bacteria obtained its DNA directly from mother cell.
(d) Bacteria obtained DNA from other external source. *(2002)*

86. The growth curve of bacterial population in lab is plotted against time. What will be the shape of graph?
(a) Sigmoid (b) Hyperbolic
(c) Ascending straight line
(d) Descending straight line *(2002)*

87. Some bacteria are able to grow in streptomycin containing medium due to
(a) natural selection
(b) induced mutation
(c) reproductive isolation
(d) genetic drift. *(2002)*

88. In bacteria, plasmid is
(a) extra chromosomal material
(b) main DNA
(c) non functional DNA
(d) repetitive gene. *(2002)*

89. Choose the correct sequence of stages of growth curve for bacteria.
(a) Lag, log, stationary, decline phase
(b) Lag, log, decline, stationary phase
(c) Stationary, lag, log, decline phase
(d) Decline, lag, log phase, stationary *(2002)*

90. Which fungal disease spreads by seed and flowers?
(a) Loose smut of wheat
(b) Corn smut
(c) Covered smut of barley
(d) Soft rot of potato *(2002)*

91. Which of the following secretes toxins during storage conditions of crop plants?
(a) *Aspergillus* (b) *Penicillium*
(c) *Fusarium* (d) *Colletotrichum* *(2002)*

92. *Cauliflower mosaic* virus contains
(a) ss RNA (b) ds RNA
(c) ds DNA (d) ss DNA. *(2001)*

93. What is true for cyanobacteria?
(a) Oxygenic with nitrogenase
(b) Oxygenic without nitrogenase
(c) Non oxygenic with nitrogenase
(d) Non oxygenic without nitrogenase *(2001)*

94. What is true for archaebacteria?
(a) All halophiles
(b) All photosynthetics
(c) All fossils
(d) Oldest living beings *(2001)*

95. Difference in gram positive and gram negative bacteria is due to
(a) cell wall (b) cell membrane
(c) ribosome (d) cytoplasm. *(2001)*

96. Adhesive pad of fungi penetrate the host with the help of
(a) mechanical pressure and enzymes
(b) hooks and suckers
(c) softening by enzymes
(d) only by mechanical pressure. *(2001)*

97. Black rust of wheat is caused by
(a) *Puccinia* (b) *Ustilago*
(c) *Albugo* (d) *Phytophthora*. *(2000)*

98. A system of classification, in which a large number of traits are considered, is
(a) natural system
(b) phylogenetic system
(c) artificial system
(d) synthetic system. *(1999)*

99. Photosynthetic bacteria have pigments in
(a) chromoplasts (b) chromatophores
(c) leucoplasts (d) chloroplasts. *(1999)*

100. Columella is a specialized structure found in the sporangium of
(a) *Spirogyra* (b) *Ulothrix*
(c) *Rhizopus* (d) none of these. *(1999)*

101. In the five kingdom system of classification, which single kingdom out of the following can include blue-green algae, nitrogen fixing bacteria and methanogenic archaebacteria?
(a) Plantae (b) Protista
(c) Monera (d) Fungi *(1998)*

102. Transfer of genetic information from one bacterium to another in the transduction process is through
(a) bacteriophages released from the donor bacterial strain
(b) another bacterium having special organ for conjugation
(c) physical contact between donor and recipient strains
(d) conjugation between opposite strain bacterium. *(1998)*

103. A bacterium divides every 35 minutes. If a culture containing 10^5 cells per ml is grown for 175 minutes, what will be the cell concentration per ml after 175 minutes?
(a) 35×10^5 cells (b) 32×10^5 cells
(c) 175×10^5 cells (d) 85×10^5 cells *(1998)*

104. The DNA of *E.coli* is
(a) double stranded and linear
(b) double stranded and circular
(c) single stranded and linear
(d) single stranded and circular. *(1998)*

105. The main role of bacteria in the carbon cycle involves
(a) chemosynthesis
(b) digestion or breakdown of organic compounds
(c) photosynthesis
(d) assimilation of nitrogenous compounds. *(1998)*

106. A few organisms are known to grow and multiply at temperatures of 100-105°C. They belong to
(a) thermophilic sulphur bacteria
(b) hot spring blue-green algae
(c) methanogenic archaebacteria
(d) marine archaebacteria. *(1998)*

107. *Puccinia* forms uredia and
(a) telia on wheat leaves
(b) aecia on barberry leaves
(c) pycnia on barberry leaves
(d) aecia on wheat leaves. *(1998)*

108. Viruses possess
(a) ribosomes to synthesize protein
(b) organelle for its vital mechanism
(c) either DNA or RNA
(d) none of these. *(1997)*

109. Which of the following is free-living aerobic non-photosynthetic nitrogen-fixing bacterium?
(a) *Nostoc* (b) *Azospirillum*
(c) *Rhizobium* (d) *Azotobacter* *(1997)*

110. The site of respiration in bacteria is
(a) ribosome (b) microsome
(c) episome (d) mesosome. *(1997)*

111. The hereditary material present in the bacterium *E.coli* is
(a) single-stranded DNA
(b) double-stranded DNA
(c) DNA
(d) RNA. *(1997)*

112. Genes are packaged into a bacterial chromosome by
(a) acidic protein (b) actin
(c) histones (d) basic protein. *(1997)*

113. Most of the lichens consist of
(a) green algae and ascomycetes
(b) brown algae and higher plant
(c) blue green algae and basidiomycetes
(d) red algae and ascomycetes. *(1997)*

114. What is the genetic material in *influenza virus*?
(a) Double helical DNA
(b) RNA
(c) Single helix DNA
(d) None of these *(1996)*

115. BGA (blue green algae) are included in which of the following groups?
(a) Bryophytes (b) Prokaryotes
(c) Protista (d) Fungi *(1996)*

116. *Azotobacter* and *Bacillus polymyxa* are the examples of

(a) pathogenic bacteria
(b) decomposers
(c) symbiotic N_2 fixer
(d) non-symbiotic N_2 fixer. *(1996)*

117. What are the sex organs provided in some bacteria?
(a) Sex pili (b) Plasmid
(c) Circular DNA (d) Gametes *(1996)*

118. Which type of DNA is found in bacteria?
(a) Circular free DNA
(b) Membrane bound DNA
(c) Straight DNA
(d) Helical DNA *(1996)*

119. Which one of the following statement about lichens is wrong?
(a) These grow very rapidly (2 cm per day).
(b) They show fungal and algal symbiotic relationships.
(c) Some of its species are eaten by reindeers.
(d) These are pollution indicators. *(1996)*

120. *Mycorrhiza* is correctly described as
(a) parasitic association between roots and some fungi
(b) symbiotic relationship between fungi and roots of some higher plants
(c) symbiosis of algae and fungi
(d) relation of ants with the stem of some trees. *(1996)*

121. The tailed bacteriophages are
(a) motile on surface of bacteria
(b) non-motile
(c) motile on surface of plant leaves
(d) actively motile in water. *(1995)*

122. A large number of organic compounds can be decomposed by
(a) *Azotobacter*
(b) chemolithotrophs
(c) *Mycoplasma*
(d) *Pseudomonas*. *(1995)*

123. The black rust of wheat is a fungal disease caused by
(a) *Albugo candida*
(b) *Puccinia graminis tritici*
(c) *Melampsora lini*
(d) *Claviceps purpurea*. *(1995)*

124. *Tobacco mosaic virus* (*TMV*) genes are
(a) single stranded RNA
(b) double stranded DNA
(c) proteinaceous
(d) double stranded RNA. *(1994)*

125. Phylogenetic classification is one which is based on
(a) overall similarities
(b) utilitarian system
(c) habits of plants
(d) common evolutionary descent. *(1994)*

126. The protists have
(a) only free nucleic acid aggregates
(b) membrane bound nucleo proteins lying embedded in the cytoplasm
(c) gene containing nucleoproteins condensed together in loose mass
(d) nucleoprotein in direct contact with the rest of the cell substance. *(1994)*

127. Organisms, which fix atmospheric nitrogen in the soil, fall under the category of
(a) bacteria (b) green algae
(c) soil fungi (d) mosses. *(1994)*

128. Transduction in bacteria is mediated by
(a) plasmid vectors (b) phage vectors
(c) cosmids (d) F-factors. *(1994)*

129. A non-photosynthetic aerobic nitrogen fixing soil bacterium is
(a) *Rhizobium* (b) *Clostridium*
(c) *Azotobacter* (d) *Klebsiella*. *(1994, 1990)*

130. Mycorrhiza exhibits the phenomenon of
(a) parasitism (b) symbiosis
(c) antagonism (d) endemism. *(1994)*

131. Schizont stage of *Plasmodium* occurs in human cells
(a) erythrocytes (b) liver cells
(c) erythrocytes and liver cells
(d) erythrocytes, liver cells and spleen cells. *(1993)*

132. If all ponds and puddles are destroyed, the organism likely to be destroyed is
(a) *Leishmania* (b) *Trypanosoma*
(c) *Ascaris* (d) *Plasmodium*. *(1993)*

133. Genophore/bacterial genome or nucleoid is made of
(a) histones and nonhistones
(b) RNA and histones
(c) a single double stranded DNA
(d) a single stranded DNA. *(1993)*

134. *Escherichia coli* is used extensively in biological research as it is
(a) easily cultured
(b) easily available
(c) easy to handle
(d) easily multiplied in host. *(1993)*

135. The part of life cycle of malarial parasite *Plasmodium vivax*, that is passed in female *Anopheles* is
(a) sexual cycle
(b) pre-erythrocytic schizogony
(c) exoerythrocytic schizogony
(d) post-erythrocytic schizogony. *(1992)*

136. Bacteria lack alternation of generation because there is
(a) neither syngamy nor reduction division
(b) distinct chromosomes are absent
(c) no conjugation
(d) no exchange of genetic material.
(1992, 1991)

137. Organisms which are indicator of SO_2 pollution of air
(a) mosses (b) lichens
(c) mushrooms (d) puffballs.
(1992)

138. An important criterion for modern day classification is
(a) resemblances in morphology
(b) anatomical and physiological traits
(c) breeding habits
(d) presence or absence of notochord.
(1991)

139. In *Amoeba* and *Paramecium* osmoregulation occurs through
(a) pseudopodia
(b) nucleus
(c) contractile vacuole
(d) general surface. *(1991)*

140. African sleeping sickness is due to
(a) *Plasmodium vivax* transmitted by tse-tse fly
(b) *Trypanosoma lewsii* transmitted by bed bug
(c) *Trypanosoma gambiense* transmitted by *Glossina palpalis*
(d) *Entamoeba gingivalis* spread by housefly.
(1991)

141. Malignant tertian malarial parasite, belongs to class
(a) *Plasmodium falciparum*
(b) *P. vivax*
(c) *P. ovale*
(d) *P. malariae.* *(1991)*

142. Who discovered *Plasmodium* in R.B.C. of human beings?
(a) Ronald Ross (b) Mendel
(c) Laveran (d) Stephens *(1991)*

143. Name the organisms which do not derive energy directly or indirectly from sun.
(a) Chemosynthetic bacteria
(b) Pathogenic bacteria
(c) Symbiotic bacteria
(d) Mould *(1991)*

144. *Plasmodium*, the malarial parasite, belongs to class
(a) sarcodina (b) ciliata
(c) sporozoa (d) dinophyceae.
(1990)

145. Amoebiasis is prevented by
(a) eating balanced food
(b) eating plenty of fruits
(c) drinking boiled water
(d) using mosquito nets. *(1990)*

146. Which is true about *Trypanosoma*?
(a) Polymorphic
(b) Monogenetic
(c) Facultative parasite
(d) Non-pathogenic *(1990)*

147. Genetic information in *Paramecium* is contained in
(a) micronucleus (b) macronucleus
(c) both micronucleus and macronucleus
(d) mitochondria. *(1990)*

148. The infective stage of malarial parasite, *Plasmodium* that enters human body is
(a) merozoite (b) sporozoite
(c) trophozoite (d) minuta form.
(1990)

149. The main difference in Gram (+)ve and Gram (–)ve bacteria resides in their
(a) cell wall (b) cell membrane
(c) cytoplasm (d) flagella.
(1990)

150. Which one belongs to monera?
(a) *Amoeba* (b) *Escherichia*
(c) *Gelidium* (d) *Spirogyra*
(1990)

151. Absorptive heterotrophic nutrition is exhibited by
(a) algae (b) fungi
(c) bryophytes (d) pteridophytes. *(1990)*

152. System of classification used by Linnaeus was
(a) natural system
(b) artificial system
(c) phylogenetic system
(d) asexual system. *(1989)*

153. Artificial system of classification was first used by
(a) Linnaeus
(b) De Candolle
(c) Pliny the Edler
(d) Bentham and Hooker. *(1989)*

154. A bite of tse-tse fly may pass to humans
(a) *Leishmania donovani*
(b) *Trypanosoma gambiense*
(c) *Entamoeba histolytica*
(d) *Plasmodium vivax*. *(1989)*

155. Malaria fever coincides with liberation of
(a) cryptomerozoties
(b) metacryptomerozoites
(c) merozoites (d) trophozoites. *(1989)*

156. *Trypanosoma* belongs to class
(a) sarcodina (b) zooflagellata
(c) ciliata (d) sporozoa. *(1989)*

157. The vector for sleeping sickness is
(a) housefly (b) tse-tse fly
(c) sandfly (d) fruit fly. *(1989)*

158. The causal organism for African sleeping sickness is
(a) *Trypanosoma cruzi*
(b) *T. rhodesiense*
(c) *T. tangela*
(d) *T. gambiense*. *(1989)*

159. Lichens indicate SO_2 pollution because they
(a) show association between algae and fungi
(b) grow faster than others
(c) are sensitive to SO_2
(d) flourish in SO_2 rich environment. *(1989)*

160. Classification given by Bentham and Hooker is
(a) artificial (b) natural
(c) phylogenetic (d) numerical. *(1988)*

Answer Key

1.	(d)	**2.**	(c)	**3.**	(b)	**4.**	(c)	**5.**	(b)	**6.**	(b)	**7.**	(b)	**8.**	(a)	**9.**	(a)	**10.**	(a)
11.	(b)	**12.**	(c)	**13.**	(d)	**14.**	(d)	**15.**	(c)	**16.**	(d)	**17.**	(c)	**18.**	(c)	**19.**	(b)	**20.**	(a)
21.	(a)	**22.**	(c)	**23.**	(d)	**24.**	(b)	**25.**	(b)	**26.**	(a)	**27.**	(a)	**28.**	(d)	**29.**	(b)	**30.**	(a)
31.	(c)	**32.**	(b)	**33.**	(c)	**34.**	(b)	**35.**	(b)	**36.**	(c)	**37.**	(d)	**38.**	(d)	**39.**	(d)	**40.**	(c)
41.	(c)	**42.**	(a)	**43.**	(d)	**44.**	(a)	**45.**	(b)	**46.**	(b)	**47.**	(c)	**48.**	(a)	**49.**	(a)	**50.**	(a)
51.	(b)	**52.**	(b)	**53.**	(c)	**54.**	(d)	**55.**	(c)	**56.**	(d)	**57.**	(d)	**58.**	(a)	**59.**	(b)	**60.**	(d)
61.	(c)	**62.**	(c)	**63.**	(d)	**64.**	(a)	**65.**	(b)	**66.**	(d)	**67.**	(b)	**68.**	(c)	**69.**	(b)	**70.**	(b)
71.	(a)	**72.**	(a)	**73.**	(a)	**74.**	(c)	**75.**	(a)	**76.**	(d)	**77.**	(d)	**78.**	(d)	**79.**	(a)	**80.**	(c)
81.	(c)	**82.**	(d)	**83.**	(d)	**84.**	(b)	**85.**	(a)	**86.**	(b)	**87.**	(a)	**88.**	(a)	**89.**	(a)	**90.**	(a)
91.	(a,b)	**92.**	(c)	**93.**	(a)	**94.**	(d)	**95.**	(a)	**96.**	(a)	**97.**	(a)	**98.**	(a)	**99.**	(b)	**100.**	(c)
101.	(c)	**102.**	(a)	**103.**	(b)	**104.**	(b)	**105.**	(b)	**106.**	(a)	**107.**	(a)	**108.**	(c)	**109.**	(d)	**110.**	(d)
111.	(b)	**112.**	(d)	**113.**	(a)	**114.**	(b)	**115.**	(b)	**116.**	(d)	**117.**	(a)	**118.**	(a)	**119.**	(a)	**120.**	(b)
121.	(a)	**122.**	(b)	**123.**	(b)	**124.**	(a)	**125.**	(d)	**126.**	(b)	**127.**	(a)	**128.**	(b)	**129.**	(c)	**130.**	(b)
131.	(c)	**132.**	(d)	**133.**	(c)	**134.**	(a)	**135.**	(a)	**136.**	(a)	**137.**	(b)	**138.**	(b)	**139.**	(c)	**140.**	(c)
141.	(a)	**142.**	(c)	**143.**	(a)	**144.**	(c)	**145.**	(c)	**146.**	(a)	**147.**	(a)	**148.**	(b)	**149.**	(a)	**150.**	(b)
151.	(b)	**152.**	(b)	**153.**	(a)	**154.**	(b)	**155.**	(b)	**156.**	(b)	**157.**	(b)	**158.**	(d)	**159.**	(c)	**160.**	(b)

EXPLANATIONS

1. (d) : Halophiles, a type of archaebacteria, usually occur in extreme saline conditions like salt pans, salt beds and salt marshes.

2. (c) : Viroids are free RNA particles that lack protein coat. They are infectious agents smaller than viruses.

3. (b) : Mycoplasmas are the smallest living cells, known without a definite cell wall. They are pathogenic to both plants and animals and can survive without oxygen.

4. (c) : Glycocalyx is the outermost mucilage layer of the cell envelope which consists of non-cellulosic polysaccharides with or without proteins. It gives sticky character to the cell.

5. (b) : DNA replicates in bacteria just before they divide by fission.

6. (b) : Cell wall in fungi is composed of chitin, a polysaccharide comprising N-acetyl-D-glucosamine (a derivative of glucose).

7. (b) : Methanogens belong to archaebacteria. They include methane producing genera such as *Methanobacillus* and *Methanothrix*. Methanogens are obligate anaerobes found in oxygen-deficient environments, such as marshes, swamps, sludge (formed during sewage treatment), and the digestive systems of ruminants. Mostly they obtain their energy by reducing carbon dioxide and oxidising hydrogen, with the production of methane.

8. (a) : Diatoms are marine or freshwater unicellular organisms which have cell walls (frustules) composed of pectin impregnated with silica and consisting of two halves, one overlapping the other. The siliceous frustules of diatoms do not decay easily.

9. (a) : *Refer to answer 7.*

10. (a) : Eubacteria are also called true bacteria.

11. (b) : RNA of viroid has low molecular weight.

12. (c) : Fungal cell wall contains chitin or fungal cellulose along with other polysaccharides, proteins, lipids and a number of other substances.

13. (d) : Protista is a kingdom of unicellular eukaryotic organisms. It includes photosynthetic protists (dinoflagellates, chrysophytes and euglenoids), consumer-decomposer protists (slime moulds) and protozoan protists.

14. (d) : *Mucor* is a member of Zygomycetes (the conjugation fungi) in which motile cells *e.g.* zoospores, planogametes, etc. are absent. Asexual reproduction takes place by the formation of non-motile mitospores called sporangiospores. Sexual reproduction takes place by the formation of non-motile zygospores.

15. (c) : Deuteromycetes are the imperfect fungi which include all those fungi in which sexual stage is either absent or not known. Some members are saprophytes or parasites while a large number of them are decomposers of litter and help in mineral cycling. *E.g.*, *Colletotrichum*, *Helminthosporium* etc.

16. (d) : Fimbriae are small bristle-like solid structures arising from bacterial cell surface. There are 300-400 of fimbriae per cell. Their diameter is 3-10 nm while length is 0.5-1.5 μm. Fimbriae are involved in attaching bacteria to solid surfaces (*e.g.*, rock in water body) or host tissues (*e.g.*, urinary tract in *Neisseria gonorrhoeae*). Some fimbriae cause agglutination of RBCs. They also help in mutual clinging of bacteria.

17. (c) : Viroids are infectious RNA particles which were discovered by T.O. Diener (1971). These are devoid of protein coat and cause diseases in plants only, *e.g.*, potato spindle tuber, chrysanthemum stunt etc.

18. (c) : Chrysophytes include diatoms and desmids. The body of diatoms is covered by a transparent siliceous shell (silica deposited in cell wall) known as frustule. The frustule is made of two valves, epitheca and hypotheca, which fit together like a soap box.

19. (b) : Kingdom Monera consists of prokaryotic organisms, characterised by absence of nuclear envelope around nucleus and absence of membrane-bound cell organelles.

20. (a) : Morels are Ascomycetes with edible ascocarps that have fleshy sponge-like conical cap or pileus and a stalk like stipe, *e.g.*, *Morchella esculenta*. Truffles are also edible members of Ascomycetes with tuber-like subterranean ascocarps that are often dug out with the help of trained dogs and pigs, *e.g.*, *Tuber aestivum*.

21. (a) : Mycoplasma (Kingdom-Monera) are the simplest and smallest free living prokaryotes which

are devoid of a cell wall. Plasma membrane forms the outer boundary of the cell of mycoplasma.
Nostoc is a cyanobacterium (Kingdom- Monera), in which cell wall comprises of peptidoglycans. *Aspergillus* is a fungus (Kingdom-Fungi) in which cell wall is mainly made of chitin. *Funaria* is a bryophyte (Kingdom-Plantae) in which cell wall is cellulosic in nature.

22. (c) : *Anabaena* is a prokaryotic organism. It is a cyanobacteria (blue green algae) which belongs to Kingdom Monera. Like all other prokaryotes, it lacks a true nucleus and other cell organelles.

23. (d) : *Alternaria* is a Deuteromycetes member which are also known as fungi imperfecti. Their perfect stages (sexually reproducing stages) are either absent or not known.

24. (b) : R.H. Whittaker considered complexity of cell structure and structural (body) organisation, mode of nutrition, ecological life style and phylogenetic relationships for the five kingdom system of classification.

25. (b) : Tobacco mosaic virus is a RNA virus that causes tobacco mosaic disease. It has single stranded coiled RNA molecule as its genetic material a part of which hangs outside the protein coat. Protein coat consists of approximately 2130 capsomeres which are helically arranged to form a hollow cylinder of about 4 nm diameter.

26. (a) : Viruses are nucleoprotein entities which are able to utilize synthetic machinery of a living cell of the host organism for its multiplication which does not involve growth and division. They have either RNA or DNA as genetic material and a protein coat.

27. (a) : The archaebacteria are the 'ancient' bacteria that include extremophiles like methanogens, halophiles and thermophiles. They represent some of the most ancient of life forms that persist today. They have both eubacterial and eukaryotic characters besides the features unique to them. Their mode of reproduction, nutrition and cell shape and size resembles a typical eubacteria. Their cell walls are made of a variety of polymers, but do not contain peptidoglycan unlike eubacteria. Lipids of their cytoplasmic membranes are ether linked unlike eubacteria which contain glycerol ester lipids in their cell membrane.

28. (d) : Mesosome is a characteristic circular to villiform specialisation of bacterial cell membrane that develops as an ingrowth. It consists of vesicles, tubules and lamellae. Mesosomes may be septal or lateral. Septal mesosome connects nucleoid with plasma membrane and assists in replication and septum formation during cells division. Lateral mesosome is not connected with nucleoid and contains respiratory enzymes and performs functions similar to eukarytoic mitochondria and hence is also called chondrioid. They also increase the surface area of plasma membrane and enzymatic contact.

29. (b) : Flagellum is the organ of motility in bacteria. Bacterial flagella are unistranded, equivalent to a single microtubular fibre and formed of protein called flagellin. They perform rotatory movements.

30. (a) : In *Rhodospirillum,* electron donor is organic compound instead of water hence no oxygen is released, *i.e.,* anoxygenic photosynthesis occurs. In other plants water is used as electron donor and H^+ and O_2 are produced during photolysis of water.

31. (c) : Archaebacteria belong to a group of prokaryotic organisms called Monera. These include the methanogens, which produce methane; the thermoacidophilic bacteria, which live in extremely hot and acidic environments (such as hot springs); and the halophilic bacteria, which can only function at high salt concentrations and are abundant in the world's oceans.

32. (b) : Chromatophore is a pigmented lamellar or vesicular structure that can be isolated from disrupted photosynthetic bacteria or cyanobacteria. Their plasma membrane may be projected in folds into the cytoplasm forming lamellae that have, therefore, double unit-membrane structure. The pigments and most of the enzymes required for the light-induced electron transport and phosphorylation processes of photosynthesis, are located in the plasma membrane and lamellae.

33. (c) : S-type bacteria or virulent bacteria are capsulated. The capsule is made up of polysaccharides and amino acids. It is a tough and thick mucilage covering. It gives protection to bacteria against host's immune system.

34. (b) : Fungi are achlorophyllous, heterotrophic, spore forming, non-vascular, eukaryotic organisms which often contain chitin or fungal cellulose in their walls. Hence, their cell wall is rigid.

35. (b) : In viruses, three architectural forms are found – helical (elongated body, *e.g.*, TMV), cuboidal (short broad body with rhombic, rounded, polyhedral shape *e.g*,. poliovirus) and binal (with both cuboidal and helical parts *e.g.*, T_2 phage).

36. (c) : Though the bacterial structure is very simple, they are very complex in behaviour. Compared to many other organisms, bacteria as a group show the most extensive metabolic diversity. Some of the bacteria are autotrophic, *i.e.,* they synthesize their own food from inorganic substrates. They may be photosynthetic autotrophic or chemosynthetic autotrophic. The vast majority of bacteria are heterotrophs, *i.e.*, they do not synthesize their own food but depend on other organisms or on dead organic matter for food.

37. (d) : *Penicillium* and *Agaricus* are fungi while *Volvox* is an alga. All three are eukaryotes thus have a membrane bound nucleus. *Nostoc* is a cyanobacterium, *i.e.,* prokaryote, so it lacks true nucleus, thus nuclear membrane is absent.

38. (d) : Cyanobacteria is a phylum consisting of two groups of photosynthetic eubacteria: the blue-green bacteria (formerly known as blue-green algae, or cyanophyta), which comprise the vast majority of members, and the grass-green bacteria, or chloroxybacteria.

39. (d) : Maximum number of antibiotics are produced by mycelial bacteria known as actinomycetes and most of the actinomycetes are saprotrophic (heterotrophic). Lactic acid bacteria that are used in preparation of curd are also heterotrophic ones.

40. (c) : Yeast is a group of unicellular fungi of the class ascomycetes. They occur as single cell or as a group or chain of cells. Yeast of the genus *Saccharomyces* ferments sugar and are used to make bread and beer.

41. (c) : *Azotobacter*, *Aspergillus* and *Trichoderma* all are free living microbes that help plants in their nutrition. *Glomus* is a fungus that symbiotically forms endomycorrhiza that helps in absorption of nutrition specially phosphorus from soil.

42. (a) : In order to develop phylogenetic classification, R.H. Whittaker (1969), an American taxonomist, divided all the organisms into five kingdoms. Whittaker has used five criteria for delimiting the different kingdoms. (i) Complexity of cell structure, prokaryotic and eukaryotic (ii) Complexity of body structure or structural organization, unicellular and multicellular. (iii) Mode of nutrition which is divergent in multicellular kingdoms. (iv) Ecological life style like producers (plantae), decomposers (fungi) and consumers (animalia), (v) Phylogenetic relationship. When such characteristics were considered, the fungi were placed in a separate kingdom – Kingdom Fungi. All prokaryotic organisms were grouped together under Kingdom Monera and the unicellular eukaryotic organisms were placed in Kingdom Protista. Kingdom Protista has brought together *Chlamydomonas*, *Chlorella* (earlier placed in Algae within Plants and both having cell walls) with *Paramoecium* and *Amoeba* (which were earlier placed in the animal kingdom which lack cell wall). It has put together organisms which, in earlier classifications, were placed in different kingdoms. This happened because the criteria for classification changed.

43. (d) : The 23S *r*RNA is a component of the large prokaryotic (bacterial cell) subunit (50S). The ribosomal peptidyl transferase activity resides in this *r*RNA and acts as a ribozyme (catalytic RNA). In eukaryotic cells, the 60S (28S component) ribosome subunit contains the peptidyl transferase component and acts as the ribozyme.

44. (a) : Plasma membrane of eubacteria resembles plasma membrane of eukaryotic cell. But nucleus, ribosomes and cell wall are little different in eukaryotic cell in their structure and organization from eubacterial cell.

45. (b) : *Escherichia coli* (bacterium) is not an example of eukaryotic cell. It is a typical example of prokaryotic cell.

46. (b) : Rust is a group of parasitic fungi of the phylum Basidiomycota. Many of these species attack the leaves and stems of cereal crops. Pathogens of rust are *Puccinia*, *Uromyces*, *Melampsora*, *Hemileia*.

47. (c) : The pathogen *Microsporum* is genus of Kingdom Fungi that causes diseases of skin and hair in humans and animals like dog, cat, monkey. Ringworm is caused by the dermatophyte fungi-species of *Microsporum*, *Trichophyton* and *Epidermophyton*.
Rhizopus, a black bread mould belongs to group zygomycetes of Kingdom Fungi.

48. (a) : The nucleic acid of a virus is surrounded by a protein coat called the capsid. The capsid is composed of protein subunits called capsomeres. In some viruses, the capsid is covered by an envelope, which usually consists of some combination of lipids, proteins and carbohydrates.

49. (a) : Protista include all unicellular and colonial eukaryotes except those of green and red algae. The protistan cells are typically eukaryotic having membrane bound organelles like mitochondria, chloroplasts, Golgi bodies, endoplasmic reticulum, nucleus etc. Protista is commonly known as kingdom of unicellular eukaryotes. Kingdom fungi contains achlorophyllous, spore producing, heterotrophic, multicellular or multinucleate eukaryotic organisms (unicellular yeasts are also included amongst fungi because their sexual reproduction is similar to that of some fungi). Monerans are basically unicellular prokaryotes. Archaea (ancient bacteria) are also a type of monerans which live in primitive environment like high temperature, high salt content, acidic pH, etc.

50. (a) : There are two major groups of monerans archaebacteria (ancient bacteria) and eubacteria (true bacteria). Eubacteria is of further two types – bacteria and cyanobacteria. Thermoacidophiles are a type of archaebacteria which live in extremely acidic environment (pH 2) that have extremely high temperatures (upto 110°C). They are found in hot sulphur springs. Some of the eubacteria are also famous for living under the most hostile environment like salt pans, petroleum pans, spilled oil, hot springs, sulphur springs, snow, etc.

51. (b) : Many free living bacteria and blue green algae are capable to fix atmospheric nitrogen *Rhodospirillum* is a free living photosynthetic anaerobic nitrogen fixing non-sulphur bacteria. It is capable of synthesizing its organic food in presence of light and in absence of O_2 by a process known as bacterial photosynthesis. *Beijernickia* and *Azotobacter* are free living but aerobic nitrogen fixing bacteria. *Rhizobium* is a symbiotic nitrogen fixing bacteria.

52. (b) : *Streptococcus* is a bacteria which is included under Kingdom Monera. Monerans have prokaryotic cell organisation in which membrane bound organelles like mitochondria, E.R., Golgi bodies, etc. are absent. All the other three *i.e.*, *Saccharomyces* (a fungus) *Chlamydomonas* (an algae) and *Plasmodium* (a protozoan protist) are eukaryotes containing true membrane bound organelles.

53. (c) : A – Head
B – Sheath
C – Collar
D – Tail fibre

54. (d) : Chemosynthetic autotrophic bacteria oxidise various inorganic substances such as nitrates, nitrites and ammonia and use the released energy for their ATP production. They play a great role in recycling nutrients like nitrogen, phosphorous, iron and sulphur.

55. (c) : Black stem rust is caused by *Puccinia graminis tritici.* The genus *Puccinia* includes 700 species, which cause rust diseases of many economic plants such as wheat, barley, oats, etc.
It is called a rust because of the reddish brown color of the spores that are found chiefly upon the surface of the host leaves and stems. *P. graminis* is heteroecious *i.e.*, requiring two hosts, wheat and barberry for the completion of normal life cycle.
According to the nature of the spores, the life cycle of the *P. graminis* is divided into five stages. It is during, teleuto stage, the teliospore (or teleutospores) produce dark brown to black pustules on the surface of stems and leaves of the wheat that results into 'black stem rust of wheat'.

56. (d) : Plylogenetic system or cladistics is based on evolutionary sequence as well as the genetic relationship among the living beings. Engler and Prantl's System of Classification was jointly proposed in *Die Naturlichen Pflanzen Familien* in 1892. It is the first phylogenetic system of classification which includes all the plants from algae to angiosperms arranged in an evolutionary sequence from simplicity to complexity.

57. (d) : *Refer to answer 17.*

58. (a) : *Oscillatoria* is a filamentous Gram-ve cyanobacteria which perform oxygenic photosynthesis because of the presence of chlorophyll-*a* like eukaryotic algae and higher plants.

59. (b) : *Frankia*, is a nitrogen fixing symbiotic bacteria. It induces root nodules just like *Rhizobium*. It is associated symbiotically with the root nodules of several non-legume plants like *Casuarina*, *Alnus*, *Rubus* etc. It cannot fix nitrogen in free state.

60. (d) : Late blight of potato disease is caused by *Phytophthora infestans*. It is a phycomycetes fungus. *Alternaria solani* is the causal organism of early blight of potato disease.

61. (c) : Bacterial leaf blight of rice is caused by *Xanthomonas oryzae* a bacterium which is gram-negative, aerobic, capsulated, and motile with a single polar flagellum. Primary infection is carried through the infected seeds. The entry of the pathogen occurs through wounds and stomata. The symptoms of the disease is the appearance of linear, yellow to straw coloured stripes, usually on both the edges of the leaf. As the disease progresses, the drying and twisting of the leaf tip occurs. The most destructive phase of the disease is the 'Ikresek' or wilt resulting from early systematic infection.

62. (c) : *Thermococcus*, *Methanococcus* and *Methanobacterium* are examples of archaebacteria which are characterized by a unique cell wall that lack peptidoglycan and consist of polysaccharides and protein and closely resemble the eukaryotic cell in the mechanism of protein synthesis, structural protein and RNA compliments of the ribosomes.

63. (d) : Archaebacteria represent a cell type that seems to possess the characteristics of both prokaryotes as well as eukaryotes. In size, the archaebacteria are about 1 μm in diameter, the size of typical prokaryotes lack membrane-bound organelles, nuclear bodies are not bound by nuclear membranes as it is in eukaryotes and ribosomes are 70S, the size of those found in typical prokaryotes. They have unique cell wall that lacks peptidoglycan, closely resemble the eukaryotic cells in the mechanisms of protein synthesis, structural proteins, and RNA compliments of the ribosomes and a very distinctive feature of archeabacterial genes is the presence of introns, elements that are totally unknown in other prokaryotes, though relatively common in eukaryotes.Archaebacteria also possess unique characteristic found in neither eukaryotes nor prokaryotes. For example, their membrane contain branched chain lipids with ether. This enables them to tolerate extremes of heat and pH.

64. (a): Slime moulds are peculiar protista that normally take the form of amoebae, but under certain conditions develop fruiting bodies that release spores, superficially similar to the sporangia of fungi. The order physarales include *Physarum species*. The fruiting bodies (sporangia) are characterized by the presence of abundant amount of calcium salt. The order comprises 142 species which are placed under 12 genera. *Physarum polycephalam* is the best known. The somatic phase is multinucleate, diploid holocarpic plasmodium which is the product of syngamy.

65. (b) : Mycoplasma are small, unicellular, (non-motile) prokaryotic organisms. They are pleomorphic. Therefore they are known as pleuro pneumonia like organisms (PPLO). They lack cell wall. It contains cytoplasm, ribosomes and DNA. They are inhibited by tetracyclines but insensitive to penicillin. They cause various diseases.

66. (d) : The *Cyathus* is known as bird's nest fungi, and *Lycoperdon* is called puff balls. Both these fungi belong to the group of club fungi or basidiomycetes. These fungi produce spores inside club shaped fruit bodies called basidium. Typically basidium has 4 basidiospores produced exogenously. *Peziza* and *Morchella*, *Claviceps* belong to ascomycetes (produce ascospores in ascocarps). Mushroom are basidiomycetes fungi.

67. (b) : Curing is a process done to add special flavour and taste in tea leaves. It is also done for tobacco. In this process after harvesting the cured leaves are hung in shade and are permitted for the action of bacteria. The curing of tea leaves is done by *Mycrococcus candidans*. *Mycrococcus* is a gram positive aerobic bacterium which is a member of micrococcaceae.

68. (c) : *Mucor* is a filamentous fungus found in the humus of soil decaying fruits, vegetables. It is commonly known as black mould. Most of the *Mucor* sp. are unable to grow at 37ºC and the strains isolated from human infections are usually one of the few thermotolerant *Mucor* sp. Colonies of *Mucor* grow rapidly at 25-30ºC, humidity about 90-95% and quickly cover the surface of the agar. It requires moist and shady place for its growth. Many sp. of *Mucor* are responsible for causing roting of fruit and vegetables. A few sp. *e.g., Mucor pusillus* are pathogenic to man.

69. (b) : *Frankia*, is a nitrogen fixing symbiotic bacteria. It induces root nodules just like *Rhizobium*. It is associated symbiotically with the root nodules of several non-legume plants like *Casuarina*, *Alnus*, *Rubus* etc. It cannot fix nitrogen in free state.

70. (b) : Retting is the process of separating fibres that are held together in close association using a variety of bacteria. Fibres of jute are held together in

close association and they are separated by the action of butyric acid bacteria *e.g. Clostridium butyricum*. These plants are immersed in water so that they absorb water and swell. Due to the activity of bacteria, the pectic substances of middle lamella are hydrolysed and the fibres are separated. These separated fibres are used in making of ropes and sacks.

71. (a) : Basopilic prokaryotes are facultatively anaerobic bacteria. They grow and multiply in very deep marine sediments. Most basophiles grow better at a pH of 8.5 or higher.

72. (a) : Lichens are peculiar dual organisms produced by the intimate association of two organisms: a fungus and an alga. The association between the two organisms is symbiosis. Both the organisms are mutually benefitted in this association and are dependent on each other. The algal cell photosynthesizes with the help of chloroplast. Therefore lichens are autotrophic. A part of these manufactured carbohydrates are used by the alga in its nutrition, the rest is supplied to the fungal partner. The fungus in turn provides water and nutrients which it absorbs from the soil using the rhizoidal hyphae. Thus both the partners get benefitted from each other. The algal partner is called phycobiont and the fungal partner is called mycobiont.

73. (a) : Retroviruses contain RNA as genetic material and this RNA is converted to DNA using enzyme reverse transcriptase.

74. (c) : Viruses like bacteriophage T4 undergo lytic cycle that involves lysis of bacteria. The replication cycle of bacteriophage T4 consists of following phases –

(i) Adsorption of the phage to bacterial or host cell. Then the viral genetic material penetrates into the host cell.

(ii) Eclipse period involves the synthesis of new phage DNA and proteins.

(iii) Maturation involves the assembly of phage DNA into the protein coat.

(iv) Lysis of host cell occurs and releases infective progeny phases.

75. (a) : Phenetic classification is a type of numerical taxonomy. In this type of classification the organisms are arranged according to overall similarity of existing organisms based on available characters. It is also called adansonian taxonomy because the same was first attempted by Adanson (1763), of course on the basis of external traits only. Numerical taxonomy evolved around 1950. It has received impetus with the availability of calculating machines and computers. In numerical taxonomy as many characters as possible are employed for evaluating degree of similarity and difference. All characteristics used in analysis are given equal weightage and importance. A proper selection of characters, their organisation and analysis in the light of current knowledge is key to success of this method. A lot of subjectivity can creep in depending upon the judgement of the biosystematist. No weightage is given to the quantity of the character present.

76. (d) : *Anabaena* is a free living nitrogen fixing cyanobacterium which can form symbiotic association with the water fern *Azolla*.

77. (d) : Prokaryotic DNA acts as a single replicating unit called replicon. Each replicon has a particular region where replication starts. It is called origin of replication or ori. In the region of ori, there is a particular nucleotide sequence called autonomic replicating sequence or ARS. Replication proceeds bidirectionally from each ori. A replication fork is produced on each side of ori. Replication will continue till a replication fork meets another replication fork.

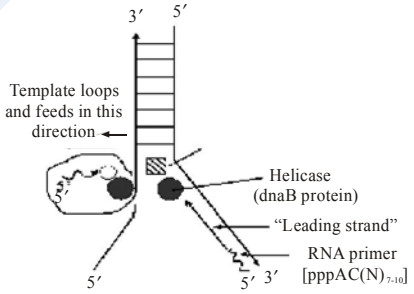


Fig. : DNA replication in prokaryotes.

78. (d) : *Refe to answer 72.*

79. (a) : Bacterial cells do not have nucleus, characteristic of eukaryotic cells. Nuclear material of bacteria lies free in the cell in the form of an irregular, thin, fibrillar and circular single molecule of DNA, called nucleoid or chromatin body. This DNA, sometimes attached at one or more points to a mesosome, frequently runs parallel to the axis of the cell. Bacterial DNA is not associated with histone protein and does not coil to form well-defined chromosomes during the multiplication. In addition to circular DNA, a small amount of subsidiary extrachromosomal DNA is also present as plasmids or episomes.

80. (c) : Viruses contain a protein coat known as capsid which encloses a single type of nucleic acid, either RNA or DNA. They do not have enzymes for protein synthesis. They multiply only inside the living host cell and for multiplication they take over the machinery of the host cell. Thus viruses are obligatory intercellular parasites. They lack cell division and enzymes for protein synthesis. They do not have cell organelles like mitochondria, Golgi complex, lysosomes, ribosomes etc. so they cannot live or reproduce separately.

81. (c) : TMV is rod shaped measuring 300 × 20 nm. It is made of RNA and proteins.

82. (d) : *Refer to answer 80.*

83. (d) : The Kingdom Monera includes all prokaryotes. They are basically unicellular but can be mycelial, colonial and filamentous. They contain peptidogycan in cell wall. Naked circular DNA coiled to form nucleoid without association with histones, ribosomes 70S, thylakoids present in photoautotrophs but other membrane bound organelles are absent. Nutrition is of various types - parasitic, chemoautotrophic, photoautotrophic and saprobic.

Some monerans have the ability to fix nitrogen. Due to presence of these characters in archaea and nitrogen-fixing organisms they are placed under monera.

All others fungi, plantae, protists and animalia are eukaryotic.

84. (b) : Whittaker's system is based on the following three criteria –

- complexity of cell structure.
- complexity of the body organization.
- mode of nutrition.

On the basis of these criteria, Whittaker divided organisms into five kingdoms. These five kingdoms are monera, protista, algae, fungi and animalia. In the five kingdom classification all, prokaryotes have been placed in kingdom monera, all unicellular eukaryotes in kingdom protista, fungi (except slime moulds and water moulds) in their separate kingdom while kingdom plantae and kingdom animalia have been retained for multicellular, autotrophic and multicellular holozoic organisms respectively.

85. (a) : In transduction, genetic material of one bacterial cell goes to other bacterial cell by agency of bacteriophages or phages (viruses, infecting bacteria).

Transduction was first of all reported in *Salmonella typhimurium* by Zinder and Lederberg (1952).

Transduction is used for gene mapping and analysis in bacteria and also for strain construction.

86. (b) : The growth curve for bacteria is hyperbolic. It shows various stages-lag phase, log phase or exponential phase, steady or stationary phase and decline phase. During lag phase there is very less growth of bacterial cells.

In log phase, once the metabolic machinery is running they start multiplying exponentially, doubling in number every few minutes. In stationary phase, booming growth stops and number of bacteria stabilises. Last is death phase when the bacteria die due to lack of nutrients.

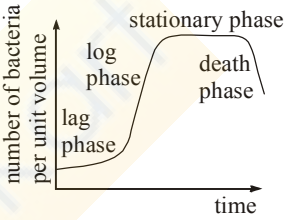


Fig. : Growth Curve

87. (a) : Normally bacteria cannot survive in antibiotic containing medium but if it does so it must have acquired resistance against that antibiotic. These are well adapted to grow in streptomycin containing medium and thus are more evolved. So due to natural selection only the more evolved and better adapted species is able to survive.

88. (a) : In addition to the nucleoid, bacterial cytoplasm normally contains many small, separate pieces of DNA, called plasmids. These circular DNA units are 1/100 the size of the main nuclear DNA (nucleoid) and are also not enclosed in a membrane structure. When found in cytoplasm, entirely independent of the bacterial chromosome, they replicate autonomously. Sometimes it becomes integrated into the main DNA and replicates with it. During conjugation, the plasmids, sometimes called episomes, help in the transfer of the genetic material between different bacteria. It may carry some genes of resistance to a variety of antibiotics.

89. (a) : *Refer to answer 86.*

90. (a) : Loose smut of wheat infects the healthy wheat plants at the time of flowering. Here chlamydospores, from smutted heads (blown by the wind) germinate on the stigmas and produce infection threads, infecting the ovaries and stigma.

Ultimately, the fungus continues to grow within the embryo, as the seed matures. With the germination of these infected seeds, internal dormant fungal mycelium resumes its activity again. In covered smut of Barley, fungal spores are liberated out only by rupturing the wall of the grains, specially at the time of threshing. This type of infection takes place during the young seedling stage. Seedling infection occurs in covered smut of Barley. Shoot infection occurs in corn smut.

91. (a, b) : *Penicillium* and *Aspergillus* both produce toxins in stored seeds and grains. *Aspergillus* produces aflatoxin in fruits, vegetables, food grains and seeds etc. *Penicillium* produces yellow rice toxins in rice, barley and corns.

92. (c) : Cauliflower mosaic virus contain dsDNA. It is circular and shows semidiscontinuous type of replication.

93. (a) : Cyanobacteria are gram negative prokaryotes which are popularly known as blue-green algae. Although cyanobacteria are true prokaryotes, but their photosynthetic system closely resembles with that of eukaryotes because they have chlorophyll *a* and photosystem II and they carry out oxygenic photosynthesis. Like the red algae, cyanobacteria use phycobiliproteins as accessory pigments. Photosynthetic pigments and electron transport chain components are located in thylakoid membranes lined with particles called phycobilisomes, which contain phycobilin pigments, particularly phycocyanin and transfer energy to photosystem II. They contain nitrogenase enzyme for nitrogen fixation. This enzyme becomes inactive in the presence of oxygen but the thick walled heterocysts provide suitable anaerobic enviornment for nitrogenase activity even in aerobic conditions.

94. (d) : Archaebacteria are believed to have originated at a time when there were extreme conditions in the biosphere. Even today they are found in environments where other kinds of bacteria cannot survive. So they are considered to be the oldest of the living fossils.
Eg. Methanobacterium, *Methonococcus* etc.
All of them are not halophiles. Only some forms like *Halobacterium*, *Halococcus* can survive under extreme saline conditions. All of them are not fossils because many forms are still surviving and flourishing.

95. (a) : Using Gram stain, developed by Danish physician, Christian Gram in 1884, two kinds of bacteria were noted - those species of bacteria that are decolorized by alcohol are called gram negative and those that retain the stain are called gram positive. This property of bacteria is related with the structure and compositional differences between the walls of gram positive and gram negative forms.
In the cell wall of Gram +ve bacteria, both horizontal and vertical peptide linkages are present, due to which mesh is dense and hence the stain does not come out. Further outer layer of cell wall of Gram +ve bacteria is made of teichoic acid.
In the cell wall of Gram –ve bacteria, either horizontal or vertical peptide linkage are present, due to which mesh is loose and hence stain comes out. Further outermost layer of cell wall of Gram –ve bacteria is made of lipopolysaccharides.

96. (a) : The adhesive pad of fungi penetrates the host with the help of mechanical pressure and enzymes. It pushes against the cell wall of the host and then releases cellulase to digest cellulose of the host cell wall so that the hypha is able to penetrate the host cell wall.

97. (a) : *Refer to answer 55.*

98. (a) : There are three systems of classification - artificial, natural and phylogenetic. In the natural system of classification the organisms are arranged on the basis of all known taxonomic characters instead of one or first few. These include morphological, anatomical, cytological, physiological and biochemical characters of the organisms.
The artificial system is based on one or a few characters that are easily observable. The phylogenetic system tries to organize organisms on the basis of their genetic and phylogenetic relationships besides taxonomic characters.

99. (b): Photosynthetic bacteria have chromatophores which are membrane bound vesicular structures which are extensions of cytoplasmic membrane. They contain photosynthetic pigments along with enzymes and electron carriers for photosynthetic phosphorylation. These pigments are bacteriochlorophyll and bacteriophaeophytin. Leucoplasts, chloroplasts and chromoplasts are different types of plasids which occur in plastids and some protistans.

100. (c) : *Rhizopus* is a saprophytic fungus that grows on dead organic matter. The mycelium is differentiated into three kinds of hyphae rhizoidal, stolons and sporangiophores. The rhizoidal

hyphae are for anchorage and absorbing food by secreting enzymes. Stolons grow horizontally over the surface of the substratum. Sporangiophores are specialized hyphae that bear a sporangium at their tip (inside columella a dome shaped sterile portion the sporangia). It helps in dispersal of spores and usually persists even after bursting of the sporangium.

101. (c) : R.H. Whittaker had proposed a five kingdom system of biological classification in 1969. It is based on complexity of cell structure, body organization and mode of nutrition. The kingdom monera includes all prokaryotes. They are basically unicellular with peptidoglycan in cell wall. Naked circular DNA coiled to form nucleoid without association with histones, ribosomes 70S, thylakoids present in photoautotrophs but other membrane bound organelles are absent. These are heterotrophic, phototrophic or chemotrophic in their mode of nutrition. The blue-green algae, nitrogen fixing bacteria and methanogenic archaebacteria are all unicellular prokaryotes so they are included in the kingdom monera.

102. (a) : Transduction is the phenomenon of transfer of genetic material from one bacterial cell to another through the agency of virus. The viruses carry a segment of DNA from one host and infect another host which is different from the first one, the latter may inherit some of the properties of the former host due to transfer of DNA segment through infecting phage.

103. (b) : A bacterium divides every 35 minutes.

$\therefore$ In 175 minutes it would be $2^{175/35}$ times $= 2^5$ times.

$\therefore$ In 175 minutes 105 bacterium cells would be $= 2^5 \times 10^5 = 32 \times 10^5$/ml.

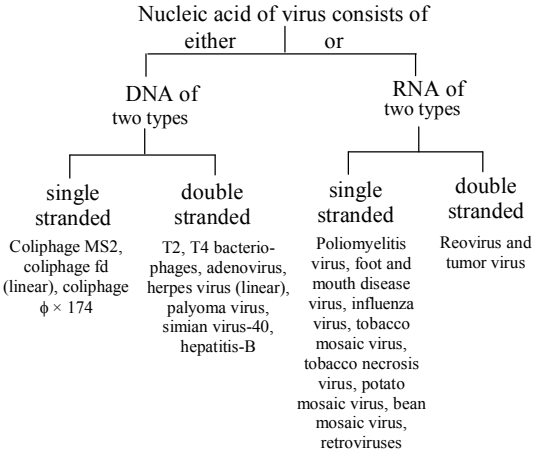
104. (b) : *E. coli* is a gram-negative, rod shaped, motile or nonmotile bacteria. *E. coli* contains a double stranded DNA as its genetic material. The DNA is not associated with any histone proteins so it is referred to as naked DNA. This DNA is circular with no free ends.

105. (b) : Bacteria are responsible for maintaining the conditions of life as the earth by virtue of their powers of decomposition of plant and animal bodies by which the limited supply by CO_2 available for photosynthesis is replenished. Thus, they act as decomposers in the carbon cycle. Bacteria mainly function as decomposers in the carbon cycle.

106. (a) : Thermoacidophiles (temperature and acid loving) archaebacteria are found in hot sulphur springs. Although they are microscopic, single-celled organisms, they flourish under conditions which would kill higher organisms. These are aerobic bacteria and have the capacity to oxidize sulphur to H_2SO_4 at high temperature and high acidity (pH = 2.0). Some of them are also able to reduce sulphur to H_2S under anaerobic conditions. As a rule, they grow best between 80º and 100ºC and several species do not grow below 80ºC.

107. (a) : *Puccinia* is a macrocyclic and heteroecious rust fungus. It produces uredia and telia stages on wheat plant. The spores produced on wheat are uredospores (stage II) and teleutospores (stage III). Uredospores can re-infect wheat but teleutospores cannot do it. Instead they give rise to basidia (stage IV). Basidiospores infect barberry. Pycnidia (stage I) develop on the upper surface of barberry leaves. Dikaryotisation occurs. It gives rise to aecidial stage (stage zero). Aecidia develop on the lower surface of barberry leaves. They form aecidiospores which infect Wheat. Thus basidial stage is produced on ground and pycnidial and aecidial stages are produced on barberry plant.

108. (c) : Viruses always contain only a single kind of nucleic acid. It can be either DNA or RNA. The nucleic acid may occur as single or double strands.



109. (d) : All plants need nitrogen to synthesize proteins, but for this purpose they are unable to utilize atmospheric nitrogen. Nitrogen fixation is brought about by two types of bacteria which are known as nitrogen fixing bacteria. One type is symbiotic nitrogen fixers that are associated with plants *e.g.*, *Rhizobium* and *Azospirillum*.

The other type of these bacteria are free living in the soil *e.g.*, *Azotobacter* and *Nostoc*.
Nostoc is photosynthetic and *Azotobacter* is non-photosynthetic.
So that, the free living aerobic non-photosynthetic nitrogen fixing bacterium is *Azotobacter*.

110. (d) : Mesosomes are complex, intracellular, membranous structures within the cytoplasm, that are formed by the infoldings of the cytoplasmic membrane. Surface of mesosomes have many enzymes which take part in respiration *e.g.,* oxidases and dehydrogenases. Mesosomes are also known to help in the separation of two daughter molecules of DNA during cell division. They are also called mitochondria of bacterial cell.

Ribosomes are cytoplasmic organelles that occur in both prokaryotes and eukaryotes. When plasmids associate temporarily with nucleoid these are called as episomes.

111. (b) : *Refer to answer 104.*

112. (d) : In bacteria, DNA is highly charged molecule. The adjacent bases are linked by phosphate groups, each with an ionized hydroxyl group. It results in negative charges which are therefore balanced by an equivalent number of cationic groups.
These charges are balanced by histones which are basic proteins in case of eukaryotes. Histones are absent in bacterial cells. In bacteria the charges are neutralized by polyamines such as spermine and spermidine and by Mg^{2+} ions.

113. (a) : Lichens are peculiar dual organisms produced by the intimate association of two organisms – a fungus and an alga. The association between the two organisms is called symbiosis. On the basis of fungal partner, lichens are of 2 types :
(i) Ascolichens : In which ascomycetes member is the fungal partner. Further in ascolichens, algal partner is mostly member of green algae and rarely blue-green algae.
(ii) Basidiolichens : Where basidiomycetes member is fungal partner. In them algal partner is generally blue-green algae. In 80% cases algal partner is member of green algae or chlorophyceae and in 20% cases, blue-green algae or myxophyceae. Important members of green algae found in lichens are: *Trebauxia*, *Pleurococcus*, *Trentepohlia* and *Cladophora*.

114. (b) : Influenza viruses are spherical in shape measuring about 800-1200Å in diameter. It has a protein capsid that encloses a single stranded RNA. The single stranded RNA is generally linear and constitutes about 10% of the virus particle. RNA is genetic material in other viruses like poliomyelitis, foot and mouth disease virus and tobacco mosaic virus etc.

115. (b)

116. (d) : Symbiosis is a mutually beneficial relationship or interaction between individuals of two different species with none of the two capable of living separately. *e.g., Rhizobium* is associated with root nodules of legumes. It fixes nitrogen for the plant and the plant provides it food and shelter. *Azotobacter* is a free-living bacteria which occurs in the soil and fixes nitrogen directly. *Bacillus* is also a free living bacteria which acts upon nitrogenous excretions and proteins of dead bodies of living organisms. These are therefore, non-symbiotic N_2 fixing bacteria.

117. (a) : Sex pili are minute and non-flagellar hairlike structures projecting from the wall of many gram negative bacteria and few Gram +ve ones. They are entirely composed of a protein called pilin. They are used as sex organs during conjugation, forms conjugation tube during conjugation. They confer the property of stickiness whereby bacteria tend to adhere to one another (clump formation). They are of two types-long conjugating pili and short attachment pili.

Naked circular DNA is the genetic material which is not enclosed by nuclear membrane non complexed with proteins. It is called nucleoid or genophore. Plasmids (Hayes and Lederberg, 1952) are additional or extrachromosomal small rings of DNA having a few useful but nonvital genes, e.g., For fertility factor, R-factors or resistance factor.

118. (a) : Bacterial cells do not have nucleus. Nuclear material of bacteria lies free in the cell in the form of an irregular, thin fibrillar and circular single molecule of DNA called nucleoid or chromatin body. This DNA is sometimes attached at one or more points to a mesosome. Bacterial DNA is not associated with histone proteins and does not coil to form well defined chromosomes during multiplication. This is the basic characteristic of all prokaryotes and bacteria is prokaryotic organism.

119. (a) : Lichens grow by extending their thallus outwards from either tips or edges. They grow very slowly. Rates of growth can vary from 0.5 mm per year to 500 mm per year. This slow growth rate equates with their long life.

120. (b) : Association between roots of higher plants *e.g.*, pine, birch and fungal hyphae is called mycorrhiza. It exhibits the phenomenon of symbiosis. Here both the organisms in association are mutually benefitted. In this, fungal hyphae take nutrition from the plant and in return increase surface area for absorption of water and minerals for the plant. Mycorrhizal roots occur in superficial layers of the soil. They are thick, irregular with wooly covering devoid of root hairs and root cap. They are of two types - ectomycorrhiza and endomycorrhiza. In the roots of *Pinus* is seen ectotrophic mycorrhiza as the root hairs are poorly developed. In ectomycorrhiza, the fungus partner is commonly a basidiomycete. It lives in intercellular spaces of cortex and forms a thick wooly covering on the outside. In endomycorrhiza, the fungus is commonly a zygomycete. The tips of fungal hyphae pass into cortical cells producing swollen vesicles or finely branched masses called arbuscules. Endomycorrhiza is, therefore, also called VAM or vesicular-arbuscular mycorrhiza. Outer covering is small. Parasitism is a phenomenon that involves a parasite which lives in constant association of the host and gets its food directly or indirectly without killing the host. Antagonism is the inhibition of growth of one organism by another. Endemism is the permanent occurrence of an organism inside another organism.

121. (a) : The tailed bacteriophages contain a hollow helical tail which serves both as cell attachment organ and as a tube that facilitates the entry of nucleic acid into the host cell. The tail consist of tail plate and the caudal fibres.

122. (b) : Chemolithotrophs can derive the energy required for growth from the oxidation of inorganic components.

123. (b) : *Puccinia graminis tritici* belongs to basidiomycotina and causes black rust of wheat. It is internal obligate parasite. It is found everywhere, where wheat is grown. The teleutospores of the fungus causes the rust. They are produced inside teleutosori. These telia form elongated, dark brown to black pustules on the surface of stems and leaves of the wheat. *Albugo candida* causes white rust of crucifers. *Melampsora lini* causes linseed rust. *Claviceps purpurea* causes ergot of graminae.

124. (a) : Tobacco Mosaic Virus is a ribovirus and contains single stranded RNA. It was proved by the experiments of Frankel Conart that RNA is the genetic material in this virus. It does not contain any DNA and is composed of 6 % RNA surrounded by a hollow cylinder of portion subunits.
Double stranded RNA is found in Reovirus and Tumor virus.
Retroviruses have two copies of single stranded RNA.

125. (d) : Phylogenetic systems of classification bring out evolutionary relationships of organisms. Phylogenetic systems of classification came into existence after acceptance of doctrine of evolution and natural selection propounded by Charles Darwin in his book "On the origin of Species" by means of Natural Selection. Darwin had put forward the view that the present day plants/animals originated from some ancestral ones after undergoing some periodical changes.
So the phylogenetic classification is based on the evolutionary descent of a group of organisms and the relationships are depicted through a phylogram and a cladogram.

126. (b) : Protists include all unicellular and colonial eukaryotes except those of green and red algae. They are broadly divided into three groups - photosynthetic, slime moulds and protozoans. The protistan cells are typically eukaryotic having membrane bound organelles like mitochondria, chloroplasts, golgi bodies, endoplasmic reticulum, nucleus etc. Nucleus is well defined. Protists can be uninucleate, binucleate or multinucleate. The genetic material is linear DNA, enclosed by nuclear envelope, complexed with proteins and organised into distinct chromosomes.

127. (a) : A few free living bacteria are able to pick up dinitrogen from the soil atmosphere and convert it into organic nitrogenous materials like amino acids. *e.g. Azotobacter*. Symbiotic nitrogen fixing bacteria of the genus *Rhizobium* occur in the root nodules of a number of legumes. Root nodules containing symbiotic nitrogen bacteria also occur in *Casuarina* and *Alnus*. Leaf nodules containing such bacteria are found in *Ardisia*. Many cyanobacteria (blue-green algae) fix atmospheric nitrogen due to presence of heterocysts.

128. (b) : In transduction, genetic material of one bacterial cell goes to other bacterial cell by agency of bacteriophages or phages (viruses, infecting bacteria).
Transduction was first of all reported in *Salmonella typhimurium* by Zinder and Lederberg (1952).
Transduction is used for gene mapping and analysis in bacteria and also for strain construction.

129. (c) : A non-photosynthetic aerobic nitrogen fixing soil bacterium is *Azotobacter*. *Azotobacter* is free living soil bacteria that are able to pick up dinitrogen from the soil and fixes it into organic nitrogenous material like amino acid.

130. (b) : *Refer to answer 120.*

131. (c) : Schizont stage of *Plasmodium* occurs in human erythrocytes and liver cells. Within the human blood the sporozoites, circulates about half an hour and enters into the liver cell. The kupffer cells of the liver clear the sporozoites from the blood stream and kill many of the organisms. A fraction of sporozoites escape destruction, however, and penetrate the hepatocytes where they take up the residence. Here they multiply by schizogony.

132. (d) : *Plasmodium* is digenetic *i.e.,* it completes its life cycle in two hosts, asexual cycle in man and sexual cycle in *Anopheles* mosquito. The breeding places of this mosquito is ponds, marshes, swampy areas etc. So, if all the ponds and puddles are destroyed, *Anopheles* will not be able to survive leading to destruction of its parasite, *Plasmodium*.

133. (c) : Bacteria has no nuclear membrane hence it is called as nucleoid. The genetic material is referred to as genophore. Genophore is the bacterial chromosome. It has a double stranded circular supercoiled DNA. DNA has about 10,000 genes in *E.coli*. Double stranded DNA in bacteria is without histones.

134. (a) : *E. coli* bacteria acts as a human symbionts and it is found in human intestine, synthesize vitamin K and B and also help in food fermentation. It is easily cultured in any nutrient medium in the laboratory.

135. (a) : *Plasmodium* has two hosts.
(i) Female *Anopheles* mosquito : Here the sexual phase of the malarial parasite occurs and it is considered the definitive host of malarial parasite.
(ii) Human beings : Here the asexual phase of malarial parasite occurs. It is considered as the intermediate host. Options (b), (c) and (d) are the stages of the asexual phase of *Plasmodium*.

136. (a) : In sexual reproduction, syngamy and meiotic division takes place but in bacteria, during sexual reproduction there is no formation of gametes hence no syngamy and reduction division occurs, bacteria lack alternation of generation. Conjugation and exchange of genetic material takes place in bacteria.

137. (b) : Lichens are found in Artic Tundra region where no other plant can grow. Lichens prefer to grow in pollution free environment. They are often used as a indicator of pollution and also they are very sensitive to SO_2. They are first to die in a polluted environment (more SO_2).

138. (b) : Taxonomy and classification are a part of the broader field of systematics which is the study of diversity of organisms. Classification of a part of systematics as it lists the unique characters of each taxon.

139. (c) : In *Amoeba* and *Paramecium,* osmoregulation occurs through contractile vacoule. Osmoregulation is a phenomenon in which contractile vacuole plays an important role in maintaining the water balance of the cell. *Paramecium* contains two contractile vacuoles which have fixed position. One contractile vacuole is present near the anterior end while another is present towards posterior end of the body. Each contractile vacuole is surrounded by 5-12 radial canals. Excess of water is transferred from the cytoplasm to the radial canals. The latter pour water into the contractile vacuole. The contractile vacuole expels water outside the body. Thus the contractile vacuoles and radial canals are for osmoregulation. In *Amoeba* the endoplasm, at its posterior end, contains a single, clear rounded and pulsating contractile vacuole, filled with a watery fluid and enclosed by a unit membrane. Surrounding this membrane is a region containing many tiny feeder vacuoles and mitochondria. It helps in the osmoregulatory and excretory activities of the animal.

140. (c) : *Trypanosoma gambiense* is the parasitic zooflagellate which causes one of the deadliest ailments in human beings called sleeping sickness or trypanosomiasis. The disease is common in humid and subhumid zones of the African continent. The disease is transmitted by shade loving tse-tse fly (*Glossina palpalis*) which acts as the vehicle that carries the culprit protozoan parasite.

141. (a) : *Plasmodium falciparum* is the greatest killer of human beings over most parts of Africa and else where in tropics. It causes malignant (or pernicious or cerebral or tropical) tertian malaria. This malaria is most harmful.
Plasmodium vivax causes benign tertian malaria. *Plasmodium malariae* causes quartan malaria. Plasmodium ovale is the rarest of the four species which infect man and it causes mild tertian malaria.

142. (c) : Laveran discovered that malaria is caused by protozoan parasite (*Plasmodium*) in 1880. He discovered *Plasmodium* and got nobel prize in 1907.

Sir Ronald Ross in 1897, a doctor in Indian Army, established that malarial parasite is transmitted by the bite of a female *Anopheles* mosquito and in 1902, he got Nobel prize for this discovery.

143. (a) : Chemosynthetic bacteria do not derive energy directly or indirectly from sun. The source of energy of these bacteria is inorganic substances. They utilise the energy liberated by oxidation of inorganic compounds and synthesize organic compounds.

144. (c) : These protozoans are adapted to parasitic mode of life. All of them are endoparasites. Locomotory organelles (cilia, flagella, pseudopodia, etc.) are absent. Organelles connected with ingestion are absent. Nutrition is parasitic (absorptive). Sexual reproduction takes place through syngamy. It is followed by spore formation, hence sporozoans. Life cycle consists of two distinct asexual and sexual phases. They may be passed in one (monogenetic) or two different hosts (digenetic).

145. (c) : Amoebiasis can be prevented by drinking boiled water as it mainly occurs by ingestion of cysts of *E. histolytica* in food or drinks. The contamination of food or drinks occurs by (i) unhygienic habits of food handlers who by habit scratch the anus and then put the fingers in the food which they serve, (ii) habit of defecating in open fields causing contamination of vegetables and then washing the bottom in ponds causing the contamination of water, (iii) transmission of cysts from stools to food and drinks by flies and cockroaches. So, one should take following preventive measures :
(I) Proper sanitation of roads, streets, lanes and open drains.
(II) Purification of drinking water (by boiling).
(III) Proper disposal of sewage.
(IV) Covering of the food articles by the traders.
(V) Chemical treatment of huma faeces to be used as fertilizer.

146. (a) : *Trypanosoma* is polymorphic *i.e.* it has more than one form. It has at least four forms that are recognized on the basis of the positions of kinetoplast and blepharoplast and the course taken by the flagellum. Two or more such forms occur either in one or both the hosts in the life cycles of various species of *Trypanosoma*. These forms are
(i) Leishmanial (amastigote) : Round or oval form with a nucleus, blepharoplast and kinetoplast. Flagellum reduced and fibril-like, embedded in cytoplasm.
(ii) Leptomonad (promastigote) : Body elongate, nucleus large and anteriorly located blepharoplast and kinetoplast. Flagellum short and unattached.
(iii) Crithidial (epimastigote) : Body elongate. Blepharoplast and kinetoplast placed immediately anterior to nucleus. Undulating membrane inconspicuous.
(iv) Trypanosomid (trypomastigote) : Body elongate and slender. Blepharoplast and kinetoplast situated at or near posterior end. Undulating membrane conspicuous.
Trypanosoma is digenetic *i.e.* it completes its life cycle in two hosts. It is an obligate parasite and is pathogenic.

147. (a) : *Paramecium* contains a single large macronucleus and one small micronucleus. The macronucleus controls metabolism such as feeding and maintaenance, whereas the micronucleus takes an important role in reproduction and stores genetic information, hence it is also termed as reproductive nucleus whereas macronucleus is termed as vegetative nucleus.

148. (b) : The infective stage of *Plasmodium* is a minute organism called sporozoite. When the mosquito bites man, sporozoites present in the salivary gland of female *Anopheles* mosquito are injected into the blood of the man. These sporozoites are spindle-shaped or sickle-shaped uninucleate organisms capable of wrigging (worm-like) movements. Each sporozoite consists of elastic pellicle, cytoplasm and nucleus.

149. (a) : Danish bacteriologists Christian Gram for the first time classified bacteria on the basis of the cell wall into two groups - Gram +ve and Gram –ve by staining with crystal violet and safranin. Gram +ve cell walls are less complex with peptidoglycan compounds and proteins and no lipids in the cell wall. Whereas in Gram –ve cell walls are more

complex with peptidoglycan compounds, phospholipids and lipopolysaccharides and contains 20% lipids.

150. (b) : All prokaryotic organisms come under Kingdom Monera. *Escherichia coli* is a bacterium. Monera includes bacteria, mycoplasmas, cyanobacteria (blue green algae) and actinomycetes.

151. (b) : The true fungi or the eumycetes are special types of achlorophyllous thallophytic organisms living a parasitic or a saprophytic mode of existence; they are always heterophytes and never autophytes. They depend on others for food, but all other groups as algae, bryophytes and pteridophytes are chlorophyll containing green plants that are autotrophic.

152. (b) : Linnaeus put forward an "Artificial system" of plant classification which was based on sexual characters like cryptogamia, monoecia, monandria, diandria, polyandria etc. It is commonly also called as sexual system of plant classification.

153. (a) : Artificial system of classification was first used by Linnaeus. The cryptogams were included in flowering plants. Linnaeus system is known as sexual system of classification. He classified on the basis of number, size and union of sex organs.

154. (b) : *Refer to answer 140.*

155. (b) : Symptoms of malaria first appear several days after the infection of the malaria parasite in man. This interval of time or the incubation period is utilized by the parasites to increase their progeny. To establish malarial symptoms, it is necessary that a large number of organisms must continue erythrocytic cycle at a time.

A healthy person acquires infection when a female *Anopheles* mosquito, containing infective stages of parasite (sporozoites) in its salivary glands, bites him for sucking his blood. Once within the numan blood, the sporozoites get into liver to invade the hepatic cells. Here they multiply asexually by schizogony. Liver schizogony has two phases, pre-erythrocytic and exo-erythrocytic:

Pre-erythrocytic phase : After penetrating a hepatic cell each sporozoite becomes a cryptozoite. It grows for a number of days and becomes a spherical and non-pigmented schizont. It divides by schizogony (multiple fission) and forms a large number of uninucleate cells, the cryptomerozoites. During pre-erythrocytic schizogony, blood remains sterile and its inoculation does not produce infection.

Exo-erythrocyic phase : Cryptomerozoites enter fresh liver cells to become metacryptozoites. They undergo schizogony similar to the previous one producing enormous number of metacrypto-merozoites.

Metacryptomerozoites, after escaping into blood stream, invade the erythrocytes or red blood corpuscles. This starts the erythrocytic schizogony. With erythrocytic schizogony, the symptoms of malaria starts appearing.

156. (b) : On the basis of locomotory organelles the protozoan protists are divided into four groups : Mastigophora, Sarcodina, Sporozoa and Ciliata. *Trypanosoma* belongs to class zooflagellata which comes under the group mastigophora. The characteristics are :

(i) These zooflagellates are generally uninucleate, occasionally multinucleate.
(ii) The body is covered by a firm pellicle.
(iii) Nutrition is holozoic, parasitic and saprobic.
(iv) Reserve food is glycogen.

157. (b) : *Refer to answer 140.*

158. (d) : *Trypanosoma gambiense* was first observed by Forde in 1901. It causes African sleeping sickness. The disease, also called trypanosomiasis, is found in western and central parts of Africa. The parasite is transmitted by blood sucking tse-tse fly, *Glossina palpalis*. Mouth and contractile vacuole are absent. Food is absorbed through the body surface. The parasite multiplies by fission. In human beings the parasite lives in the blood plasma. It causes trypanosoma fever. It is accompanied by glandular swelling. Later the parasite enters cerebrospinal fluid and damages the brain. It makes the patient lethargic and unconscious. Because of it, the disease is called sleeping sickness. If untreated, the disease leads to death.

159. (c) : Lichens are found in Artic Tundra region where no other plant can grow. Lichens prefer to grow in pollution free environment. They are often used as a indicator of pollution and also they are very sensitive to SO_2. They are first to die in a polluted environment (more SO_2).

160. (b) : Classification given by Bentham and Hooker is Natural System. Monocots were placed after dicots; closely related families were seperated; gymnosperms were placed between dicots and monocots.