

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) The presence of membrane-enclosed organelles is a characteristic of \_\_\_\_\_  
A) all cells. B) prokaryotic cells.  
C) viruses. D) eukaryotic cells.

Answer: D

- 2) Prokaryotes are made up of which two groups? \_\_\_\_\_  
A) *Bacteria* and fungi B) *Bacteria* and *Archaea*  
C) protozoa and animals D) *Archaea* and fungi

Answer: B

- 3) Protein-coding sequences of DNA are known as \_\_\_\_\_  
A) genes. B) chromosomes. C) histones. D) RNA segments.

Answer: A

- 4) The Gram stain differentiates bacterial cells into gram positive and gram negative based on differences in the \_\_\_\_\_  
A) presence of a plasmid. B) cell's metabolic capabilities.  
C) cell wall structure. D) genomic content.

Answer: C

- 5) Disease-causing prokaryotes are found exclusively among the \_\_\_\_\_  
A) fungi. B) *Bacteria*. C) *Archaea*. D) viruses.

Answer: B

- 6) Organisms most likely to be found in extreme environments are \_\_\_\_\_  
A) *Archaea*. B) *Bacteria*. C) viruses. D) fungi.

Answer: A

- 7) Cyanobacteria are most closely related to the \_\_\_\_\_  
A) *Archaea*. B) gram-positive *Bacteria*.  
C) gram-negative *Bacteria*. D) *Eukarya*.

Answer: B

- 8) Syphilis and Lyme disease are both caused by \_\_\_\_\_  
A) toxins from the *Streptomyces*. B) mycoplasmas.  
C) spirochetes. D) endospores from the *Bacillus* group.

Answer: C

- 9) Which of the following organisms lives within the host cell as a means of avoiding destruction by the host's immune response? \_\_\_\_\_  
A) *Streptococcus sp.* B) *Mycobacterium tuberculosis*  
C) *Deinococcus radiodurans* D) *Chloroflexus sp.*

Answer: B

- 10) At the present time, \_\_\_\_\_ phyla of the *Archaea* have been identified. 10) \_\_\_\_\_  
A) 2 B) 3 C) 4 D) 5  
Answer: A
- 11) Which statement is TRUE about the genus *Natronobacterium*? 11) \_\_\_\_\_  
A) They are halophilic and alkaliphilic. B) They are acidophilic but not halophilic.  
C) They are alkaliphilic but not halophilic. D) They are halophilic and acidophilic.  
Answer: A
- 12) Which statement is TRUE? 12) \_\_\_\_\_  
A) Yeasts are degenerate plants, whereas molds are fungi.  
B) Yeasts are fungi, whereas molds are degenerate plants.  
C) Both yeasts and molds are degenerate plants.  
D) Both yeasts and molds are fungi.  
Answer: D
- 13) In a lichen, the \_\_\_\_\_ is the phototrophic component, and the \_\_\_\_\_ provides the phototroph with an anchor and with protection from the elements. 13) \_\_\_\_\_  
A) alga or cyanobacterium / fungus B) fungus / cyanobacterium  
C) fungus / alga D) alga / cyanobacterium  
Answer: A
- 14) The eukaryotic fruiting body is generally associated with the 14) \_\_\_\_\_  
A) slime mold. B) *Paramecium*. C) yeast. D) trypanosome.  
Answer: A
- 15) Early branching *Eukarya* lack 15) \_\_\_\_\_  
A) genetic material. B) nuclei.  
C) ribosomes. D) mitochondria.  
Answer: D
- 16) In relation to eukaryotic cells, prokaryotic cells are generally 16) \_\_\_\_\_  
A) about the same size.  
B) smaller.  
C) larger.  
D) There is no general rule about comparative cell size.  
Answer: B
- 17) Paired chromosomes are found in 17) \_\_\_\_\_  
A) bacteria. B) viruses. C) *Archaea*. D) eukaryotes.  
Answer: D
- 18) Mechanisms for controlling gene expression are found 18) \_\_\_\_\_  
A) only in eukaryotes.  
B) only in prokaryotes.  
C) in all cells, prokaryotic and eukaryotic.  
D) in some but not all prokaryotes and in some but not all eukaryotes.  
Answer: C

- 19) Ribosomal RNA-based studies reveal that 19) \_\_\_\_\_  
A) all organisms are thought to have diverged from a common ancestral organism (LUCA) or community of organisms.  
B) all eukaryotic organisms are related but that all prokaryotic organisms are not necessarily related.  
C) the *Archaea* are most closely related to the viruses.  
D) all prokaryotic organisms are related but that all eukaryotic organisms are not necessarily related.  
Answer: A
- 20) Which statement is TRUE? 20) \_\_\_\_\_  
A) All natural and most synthetic compounds can be broken down by one or more microorganisms.  
B) All synthetic and most natural compounds can be broken down by one or more microorganisms.  
C) Most natural and most synthetic compounds can be broken down by one or more microorganisms.  
D) All natural and all synthetic compounds can be broken down by one or more microorganisms.  
Answer: A
- 21) According to our present understanding, mitochondria and chloroplasts are \_\_\_\_\_ in origin. 21) \_\_\_\_\_  
A) eukaryotic                      B) viral                      C) bacterial                      D) archaeal  
Answer: C
- 22) The model organism for microbial physiology, biochemistry, and molecular biology is 22) \_\_\_\_\_  
A) *Escherichia coli*.                      B) *Azotobacter sp.*  
C) *Pseudomonas aeruginosa*.                      D) *Candida albicans*.  
Answer: A
- 23) Which of the following groups of organisms is NOT gram positive? 23) \_\_\_\_\_  
A) *Streptococcus*                      B) *Lactobacillus*                      C) *Clostridium*                      D) *Pseudomonas*  
Answer: D
- 24) RNA-based phylogenies have influenced which subdiscipline(s) of microbiology? 24) \_\_\_\_\_  
A) clinical diagnostics                      B) microbial classification  
C) microbial ecology                      D) all of the above  
Answer: D
- 25) What type of energy-yielding metabolism is found ONLY in prokaryotes? 25) \_\_\_\_\_  
A) phototrophy                      B) autotrophy  
C) chemolithotrophy                      D) chemoorganotrophy  
Answer: C
- 26) In which of the following habitats might an extremophile be isolated? 26) \_\_\_\_\_  
A) freshwater pond                      B) boiling hot springs  
C) human skin                      D) garden soil at neutral pH  
Answer: B



- 35) Fluorescent microscopy is commonly used in \_\_\_\_\_  
A) cancer therapy.  
B) the detection of chemical contaminants in a solution.  
C) radiation biology.  
D) clinical diagnostic microbiology.

Answer: D

- 36) *Bacteria* stain as gram positive or gram negative because of differences in the cell \_\_\_\_\_  
A) cytoplasm. B) wall. C) chromosome. D) nucleus.

Answer: B

- 37) What type of microscopy has found widespread use in microbial ecology because of its ability to resolve the different layered components of a biofilm? \_\_\_\_\_  
A) differential interference contrast (DIC) microscopy  
B) dark-field microscopy  
C) scanning electron microscopy  
D) confocal scanning laser microscopy (CSLM)

Answer: D

- 38) Why is the presence of a cell wall significant from a clinical standpoint? \_\_\_\_\_  
A) Only gram-negative *Bacteria* have cell walls.  
B) All types of cells have a cell wall, and it makes identification of the causative agent of disease difficult.  
C) Animal cells do not have cell walls, so antibiotics that target cell walls can destroy invading microorganisms.  
D) The cell wall protects microorganisms from destruction by the immune system.

Answer: C

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 39) Microorganisms today are probably a degeneration of the earliest life forms. \_\_\_\_\_  
Answer: True ☒ False

- 40) Ribosomes function primarily in energy production. \_\_\_\_\_  
Answer: True ☒ False

- 41) Prokaryotic chromosomes are generally linear. \_\_\_\_\_  
Answer: True ☒ False

- 42) Meiosis is the process by which haploid gametes are formed. \_\_\_\_\_  
Answer: ☒ True False

- 43) Ribosomal RNAs can be used to study phylogenetic relationships between organisms. \_\_\_\_\_  
Answer: ☒ True False

- 44) Endosymbiosis is an explanation for the origin of mitochondria and chloroplasts in eukaryotic cells. \_\_\_\_\_  
Answer: ☒ True False

- 45) Phototrophs use light as an energy source. \_\_\_\_\_  
Answer: ☒ True False

- 46) Viruses necessarily cause disease in the organisms they infect. 46) \_\_\_\_\_  
 Answer: True ☒ False
- 47) Species of *Archaea* are more closely related to *Eukarya* than to *Bacteria*. 47) \_\_\_\_\_  
 Answer: ☒ True False
- 48) The waste products of chemoorganotrophs are often used for energy by chemolithotrophs. 48) \_\_\_\_\_  
 Answer: ☒ True False
- 49) The evolutionary significance of extreme thermophiles may be that they are modern descendants of very ancient cell lines dating back to a time when the planet was very warm. 49) \_\_\_\_\_  
 Answer: ☒ True False
- 50) Organisms of the genus *Halobacterium* can grow within salt crystals. 50) \_\_\_\_\_  
 Answer: ☒ True False
- 51) The *Picrophilus* are the most alkaliphilic prokaryotes known. 51) \_\_\_\_\_  
 Answer: True ☒ False
- 52) All known *Archaea* are extremophiles of one sort or another. 52) \_\_\_\_\_  
 Answer: True ☒ False
- 53) The cyanobacteria were the first oxygenic phototrophs to evolve on Earth. 53) \_\_\_\_\_  
 Answer: ☒ True False
- 54) The genus *Chlamydia* harbors respiratory and sexually transmitted pathogens of humans. 54) \_\_\_\_\_  
 Answer: ☒ True False
- 55) A differential stain is called "differential" because it does not stain all kinds of cells the same color. 55) \_\_\_\_\_  
 Answer: ☒ True False
- 56) In bright-field microscopy, contrast differences arise because different cells and cellular components absorb and scatter light in varying degrees. 56) \_\_\_\_\_  
 Answer: ☒ True False
- 57) In phase-contrast microscopy, the differences in refractive indices between organisms and their environments are utilized for better viewing of living specimens. 57) \_\_\_\_\_  
 Answer: ☒ True False
- 58) Light microscopy is an effective way of viewing objects in three dimensions. 58) \_\_\_\_\_  
 Answer: True ☒ False

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 59) The distinct feature of the Planctomyces group is a(n) \_\_\_\_\_. 59) \_\_\_\_\_  
 Answer: distinct stalk allowing for attachment to a solid substratum
- 60) To say that an organism is an "obligate intracellular parasite" means \_\_\_\_\_. 60) \_\_\_\_\_  
 Answer: the organism must live inside of another organism to survive

- 61) One major difference between chromosomes and plasmids is that plasmids generally contain \_\_\_\_\_ rather than \_\_\_\_\_ genes. 61) \_\_\_\_\_  
Answer: genes conferring special properties / housekeeping (essential)
- 62) A eukaryotic, chlorophyll-containing organism that can live in environments containing only a few minerals, water, carbon dioxide, and light is a(n) \_\_\_\_\_. 62) \_\_\_\_\_  
Answer: alga
- 63) Two major roles of fungi are \_\_\_\_\_ and \_\_\_\_\_. 63) \_\_\_\_\_  
Answer: any two of the following in any order: food / medicine / decay / recycling of nutrients / biodegradation in nature / recycling of organic matter
- 64) The entire span of heritable nucleotides, both protein-encoding and non-encoding regions, in an organism is collectively called the \_\_\_\_\_. 64) \_\_\_\_\_  
Answer: genome
- 65) The evolutionary relationships between organisms are studied in the science of \_\_\_\_\_. 65) \_\_\_\_\_  
Answer: phylogeny
- 66) The three options by which an organism may obtain energy are: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. 66) \_\_\_\_\_  
Answer: organic chemicals / inorganic chemicals / light (any order)
- 67) The difference between chemoorganotrophy and chemolithotrophy is \_\_\_\_\_. 67) \_\_\_\_\_  
Answer: Answers will vary, but chemoorganotrophs use organic compounds as an energy source and chemolithotrophs use inorganic compounds as an energy source.
- 68) A cell that uses carbon dioxide as its carbon source is a(n) \_\_\_\_\_. 68) \_\_\_\_\_  
Answer: autotroph
- 69) The largest division (or phylum) of *Bacteria* is the \_\_\_\_\_. 69) \_\_\_\_\_  
Answer: *Proteobacteria*
- 70) The unique feature of the mycoplasmas is the \_\_\_\_\_. 70) \_\_\_\_\_  
Answer: lack of a cell wall
- 71) The function of the chloroplast is to \_\_\_\_\_. 71) \_\_\_\_\_  
Answer: carry out photosynthesis in eukaryotic cells
- 72) Lichens are called mutualistic organisms because \_\_\_\_\_. 72) \_\_\_\_\_  
Answer: they are composed of two organisms that live together for mutual benefit
- 73) The commonality linking the *Aquifex* and *Thermotoga* species is \_\_\_\_\_. 73) \_\_\_\_\_  
Answer: both groups grow at near-boiling-point temperatures
- 74) \_\_\_\_\_ are a specialized cell type found in certain filamentous cyanobacteria that carry out a globally important process known as \_\_\_\_\_. 74) \_\_\_\_\_  
Answer: Heterocysts / nitrogen fixation

- 75) The \_\_\_\_\_ provides structural strength to plant cells and most microorganisms. 75) \_\_\_\_\_  
Answer: cell wall
- 76) Cyanobacteria and their phylogenetic relatives undergo a process known as \_\_\_\_\_ in 76) \_\_\_\_\_  
which molecular oxygen is liberated.  
Answer: oxygenic photosynthesis
- 77) The two eukaryotic organelles involved in energy generation are \_\_\_\_\_ and \_\_\_\_\_. 77) \_\_\_\_\_  
Answer: mitochondria / chloroplasts (either order)
- 78) The measure of the light-gathering ability of the objective lens is known as the \_\_\_\_\_. 78) \_\_\_\_\_  
Answer: numerical aperture

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

- 79) What might you learn by taking a properly stained sample of water and placing it under a light microscope?  
Answer: Possible answers include cell abundance, cell associations either with other cells or abiotic particles, cell morphology, diversity estimation, multi-cellular or unicellular presence, and sterility of sample.
- 80) Explain the similarities and differences between viruses and true cells.  
Answer: Answers will vary, but one similar feature is that both have a nucleic-acid based genome. A difference that should be emphasized is how viruses depend on a host for metabolism.
- 81) Why are the *Archaea* so difficult to study in the laboratory?  
Answer: Answers will vary, but a theme should be the challenge of growing them in the lab due to their distinguishing characteristic of being extremophiles. Examples could include various harsh conditions such as boiling temperatures sustained in a liquid medium.
- 82) Why are most of the "early branching" *Eukarya* pathogenic or parasitic?  
Answer: Answers should generally include a statement about the organisms being unable to live a free and independent existence.
- 83) Explain the role of the methanogens in ecological studies.  
Answer: Answers will vary, but methanogens should be highlighted as those microorganisms involved in the final stages of biomass decomposition, where the methane can be assimilated to begin remaking large carbon-containing molecules (in the carbon cycle).
- 84) Compare and contrast algae and cyanobacteria.  
Answer: Answers will vary. Possible answers include: Algae are eukaryotes and cyanobacteria are prokaryotes. Both are photosynthetic.
- 85) In what way are the *Thermoplasma* like the *Mycoplasma*?  
Answer: Answers will vary but should include a statement that they both lack a cell wall.
- 86) Explain the concept of domain in relation to the tree of life.  
Answer: Answers will vary but should include a description of unifying characteristics of a domain and how some characteristics are shared and therefore create a network (tree) of domains.



87) Sketch a phylogenetic tree showing the domains and major branches.

Answer: Answers will vary, but the sketch should resemble "the phylogenetic tree of life" (Figure 2.17) in the textbook.

88) Elaborate on how chemolithotrophy and phototrophy have influenced microbial competition and, thus, microbial habitats.

Answer: Answers will vary. One possible discussion could focus on how these different ways of obtaining energy allow microorganisms to thrive in the same habitat and minimize competition for resources by having different physiologies.

89) Explain why primary producers, especially those that undergo oxygenic photosynthesis, are essential for life on Earth.

Answer: Answers will vary, but a theme should be how oxygen must be cycled back into a usable form for aerobes by organisms that evolve oxygen during photosynthesis as long as aerobic organisms continually use up gaseous oxygen.

90) Compare and contrast the mechanisms of differential interference contrast (DIC) microscopy and confocal scanning laser microscopy (CSLM).

Answer: Answers will vary, but one unifying characteristic is both yield three-dimensional images. Differing features could include computational requirements, staining procedures, and the principles of how an image is observed.

91) Compare and contrast both the purposes and the functions of the transmission electron microscope and the scanning electron microscope.

Answer: Answers will vary, but a major similarity that should be emphasized is the employment of electrons (rather than a light source) to greatly increase the limit of magnification and resolution. Contrastive examples could include sample preparation requirements and the different cell structures observable in each.