

- B) They are halophilic and alkaliphilic.
- C) They are acidophilic but not halophilic.
- D) They are halophilic and acidophilic.

- 12) Which statement is true? 12) _____
- A) Both yeasts and molds are fungi.
 - B) Both yeasts and molds are degenerate plants.
 - C) Yeasts are fungi, whereas molds are degenerate plants.
 - D) Yeasts are degenerate plants, whereas molds are fungi.
- 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) fungus / alga
 - B) fungus / cyanobacterium
 - C) alga or cyanobacterium / fungus
 - D) alga / cyanobacterium
- 14) The eukaryotic fruiting body is generally associated with the 14) _____
- A) yeast.
 - B) slime mold.
 - C) trypanosome.
 - D) *Paramecium*.
- 15) Early branching *Eukarya* lack 15) _____
- A) genetic material.
 - B) ribosomes.
 - C) mitochondria.
 - D) nuclei.
- 16) In relation to eukaryotic cells, prokaryotic cells are generally 16) _____
- A) smaller.
 - B) about the same size.
 - C) larger.
 - D) There is no general rule about comparative cell size.
- 17) Paired chromosomes are found in the 17) _____
- A) eukaryotes.
 - B) *Archaea*.
 - C) bacteria.
 - D) viruses.
- 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.
- 19) Ribosomal RNA-based studies reveal that 19) _____
- A) all eukaryotic organisms are related but that all prokaryotic organisms are not necessarily related.
 - B) all organisms are thought to have diverged from a common ancestral organism or community of organisms.
 - C) all prokaryotic organisms are related but that all eukaryotic organisms are not necessarily related.
 - D) the *Archaea* are most closely related to the viruses.
- 20) Which statement is true? 20) _____

- A) Most 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) All natural and all synthetic compounds can be broken down by one or more microorganisms.
- D) All natural and most synthetic compounds can be broken down by one or more microorganisms.

- 21) According to our present understanding, mitochondria and chloroplasts are probably _____ in origin. 21) _____
- A) eukaryotic
 - B) archaeal
 - C) viral
 - D) bacterial
- 22) The model organism for microbial physiology, biochemistry, and molecular biology is 22) _____
- A) *Candida albicans*.
 - B) *Azotobacter sp.*
 - C) *Pseudomonas aeruginosa*.
 - D) *Escherichia coli*.
- 23) Which of the following groups of organisms is not gram-positive? 23) _____
- A) *Clostridium*
 - B) *Pseudomonas*
 - C) *Streptococcus*
 - D) *Lactobacillus*
- 24) RNA-based phylogenies have impacted many subdisciplines of microbiology, including 24) _____
- A) clinical diagnostics.
 - B) microbial classification.
 - C) microbial ecology.
 - D) all of the above.
- 25) What type of energy-yielding metabolism is found only in prokaryotes? 25) _____
- A) phototrophy
 - B) chemoorganotrophy
 - C) autotrophy
 - D) chemolithotrophy
- 26) In which of the following habitats might an extremophile be isolated? 26) _____
- A) boiling hot springs
 - B) garden soil at neutral pH
 - C) a freshwater pond
 - D) human skin
- 27) Which organism has unusual cell walls, can reassemble its chromosome after it has been damaged, and has an innate resistance to high levels of radiation? 27) _____
- A) *Lactobacillus*
 - B) *Chlamydia*
 - C) *Deinococcus*
 - D) *Pseudomonas*
- 28) How was it determined that mitochondria and chloroplasts of eukaryotes are actually ancestors of specific lineages of *Bacteria*? 28) _____
- A) clinical diagnosis
 - B) molecular sequencing
 - C) evolutionary studies
 - D) visual inspection
- 29) The ultimate limit of what we are able to see with a microscope is dictated by 29) _____
- A) light intensity.
 - B) magnification.
 - C) resolution.
 - D) visual acuity.

- 30) The most common type of microscopy for laboratory courses in biology and microbiology is done with the _____
A) bright-field microscope. B) electron microscope.
C) phase-contrast microscope. D) dark-field microscope.
- 31) When the oil-immersion lens is used, _____
A) light rays are collected to increase clarity.
B) objects are held in place on the microscope slide.
C) light rays are scattered so unnecessary background material is not seen.
D) magnification of objects is increased by about tenfold.
- 32) A tiny stylus positioned so close to a specimen that weak repulsive forces are established is used in _____
A) dark-field microscopy.
B) atomic force microscopy.
C) confocal scanning laser microscopy.
D) none of the above.
- 33) The cytoplasmic membrane is the _____
A) source of nutrient production.
B) primary support structure of the cell.
C) structure that identifies a cell as eukaryotic or prokaryotic.
D) permeability barrier of the cell.
- 34) If the magnification of an ocular lens of a particular microscope is 10× and the magnification of the objective on the same microscope is 47×, the total magnification achieved is _____
A) 57×. B) 4.7×. C) 4,700×. D) 470×.
- 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.
- 36) *Bacteria* stain as gram-positive or gram-negative because of differences in the cell _____
A) nucleus. B) chromosome.
C) wall. D) cytoplasm.
- 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) dark-field microscopy
B) confocal scanning laser microscopy (CSLM)
C) differential interference contrast (DIC) microscopy
D) scanning electron microscopy
- 38) Why is the presence of a cell wall significant from a clinical standpoint? _____
A) All types of cells have a cell wall and it makes identification of the causative agent of disease difficult.

- B) Only gram-negative *Bacteria* have cell walls.
- C) The cell wall protects microorganisms from destruction by the immune system.
- D) Animal cells do not have cell walls, so antibiotics that target cell walls can destroy invading microorganisms.

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. 39) _____
- 40) Ribosomes function primarily in energy production. 40) _____
- 41) Prokaryotic chromosomes are generally linear. 41) _____
- 42) Meiosis is the process by which haploid gametes are formed. 42) _____
- 43) Ribosomal RNAs can be used to study phylogenetic relationships between organisms. 43) _____
- 44) Endosymbiosis is an explanation for the origin of mitochondria and chloroplasts in eukaryotic cells. 44) _____
- 45) Phototrophs use light as an energy source. 45) _____
- 46) Viruses necessarily cause disease in the organisms they infect. 46) _____
- 47) Species of *Archaea* are more closely related to *Eukarya* than to *Bacteria*. 47) _____
- 48) The waste products of chemoorganotrophs are often used for energy by chemolithotrophs. 48) _____
- 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) _____
- 50) Organisms of the genus *Halobacterium* can grow within salt crystals. 50) _____
- 51) The *Picrophilus* are the most alkaliphilic prokaryotes known. 51) _____
- 52) All known *Archaea* are extremophiles of one sort or another. 52) _____
- 53) The cyanobacteria were the first oxygenic phototrophs to evolve on Earth. 53) _____
- 54) The genus *Chlamydia* harbors respiratory and sexually transmitted pathogens of humans. 54) _____
- 55) A differential stain is called "differential" because it does not stain all kinds of cells the same color. 55) _____
- 56) In bright-field microscopy, contrast differences arise because different cells and cellular components absorb and scatter light in varying degrees. 56) _____

56) _____

57) In phase-contrast microscopy, the differences in refractive indices between organisms and their environments are utilized for better viewing of living specimens. 57) _____

58) Light microscopy is an effective way of viewing objects in three dimensions. 58) _____

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) _____

60) To say that an organism is an "obligate intracellular parasite" means _____. 60) _____

61) One major difference between chromosomes and plasmids is that plasmids generally contain _____ rather than _____ genes. 61) _____

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) _____

63) Two major roles of fungi are _____ and _____. 63) _____

64) The total number of genes within a cell is called the _____. 64) _____

65) The evolutionary relationships between organisms are studied in the science of _____. 65) _____

66) The three options by which an organism may obtain energy are: _____, _____, and _____. 66) _____

67) The difference between chemoorganotrophy and chemolithotrophy is _____. 67) _____

68) A cell that uses carbon dioxide as its carbon source is a(n) _____. 68) _____

69) The largest division (or phylum) of *Bacteria* is the _____. 69) _____

70) The unique feature of the mycoplasmas is the _____. 70) _____

71) The function of the chloroplast is to _____. 71) _____

72) Lichens are called mutualistic organisms because _____. 72) _____

73) The commonality linking the *Aquifex* and *Thermotoga* species is _____. 73) _____

- 74) The most thermophilic of all known prokaryotes is _____. 74) _____
- 75) The _____ provides structural strength to plant cells and most microorganisms, while the _____ serves a similar function in animal cells. 75) _____
- 76) Cyanobacteria and their phylogenetic relatives undergo a process known as _____ in which molecular oxygen is liberated. 76) _____
- 77) The two eukaryotic organelles involved in energy generation are _____ and _____. 77) _____
- 78) The measure of the light-gathering ability of the objective lens is known as the _____. 78) _____

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

- 79) Compare and contrast the green sulfur bacteria and the green nonsulfur bacteria.
- 80) Explain the similarities and differences between viruses and true cells.
- 81) Why are the *Archaea* so difficult to study in the laboratory?
- 82) Why are most of the "early branching" *Eukarya* pathogenic or parasitic?
- 83) Explain the role of the methanogens in ecological studies.
- 84) Compare and contrast algae and cyanobacteria.
- 85) In what way are the *Thermoplasma* like the *Mycoplasma*?
- 86) Explain the concept of domain in relation to the tree of life.
- 87) Sketch a phylogenetic tree showing the domains and major branches.
- 88) Elaborate on how chemolithotrophy and phototrophy have influenced microbial competition and, thus, microbial habitats.
- 89) Explain why primary producers, especially those that undergo oxygenic photosynthesis, are essential for life on Earth.
- 90) Compare and contrast the mechanisms of differential interference contrast (DIC) microscopy and confocal scanning laser microscopy (CSLM).
- 91) Compare and contrast both the purposes and the functions of the transmission electron microscope and the scanning electron microscope.

- 1) C
- 2) C
- 3) D
- 4) C
- 5) D
- 6) A
- 7) D
- 8) A
- 9) D
- 10) A
- 11) B
- 12) A
- 13) C
- 14) B
- 15) C
- 16) A
- 17) A
- 18) C
- 19) B
- 20) D
- 21) D
- 22) D
- 23) B
- 24) D
- 25) D
- 26) A
- 27) C
- 28) B
- 29) C
- 30) A
- 31) A
- 32) B
- 33) D
- 34) D
- 35) D
- 36) C
- 37) B
- 38) D
- 39) FALSE
- 40) FALSE
- 41) FALSE
- 42) TRUE
- 43) TRUE
- 44) TRUE
- 45) TRUE
- 46) FALSE
- 47) TRUE
- 48) TRUE
- 49) TRUE
- 50) TRUE
- 51) FALSE

- 52) FALSE
- 53) TRUE
- 54) TRUE
- 55) TRUE
- 56) TRUE
- 57) TRUE
- 58) FALSE
- 59) distinct stalk allowing for attachment to a solid substratum
- 60) the organism must live inside of another organism in order to survive
- 61) genes conferring special properties / housekeeping (essential)
- 62) alga
- 63) food / medicine / decay / recycling of nutrients / biodegradation in nature / recycling of organic matter (any two) (any order)
- 64) genome
- 65) phylogeny
- 66) organic chemicals / inorganic chemicals / light (any order)
- 67) Answers will vary but chemoorganotrophs use organic compounds as an energy source and chemolithotrophs use inorganic compounds as an energy source.
- 68) autotroph
- 69) *Proteobacteria*
- 70) lack of a cell wall
- 71) carry out photosynthesis in eukaryotic cells
- 72) they are composed of two organisms that live together for mutual benefit
- 73) both groups grow at near-boiling-point temperatures
- 74) *Pyrolobus*
- 75) cell wall / cytoskeleton
- 76) oxygenic photosynthesis
- 77) mitochondria / chloroplasts
- 78) numerical aperture
- 79) Answers will vary.
- 80) Answers will vary.
- 81) Answers will vary.
- 82) Answers will vary but generally the answer should include a statement about the organisms being unable to live a free and independent existence.
- 83) Answers will vary.
- 84) Answers will vary. Possible answers include: Algae are eukaryotes and cyanobacteria are prokaryotes. Both are photosynthetic.
- 85) Answers will vary but should include a statement that they both lack a cell wall.
- 86) Answers will vary.
- 87) Answers will vary, but the sketch should resemble the "domain tree" in text.
- 88) Answers will vary.
- 89) Answers will vary.
- 90) Answers will vary.
- 91) Answers will vary.