Exam

Name_____

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

1) Which statement is generally NOT true? 1) _____
A) Microbial cells include both bacteria and viruses.
B) Microbial cells exclude the cells of plants and animals.
C) Microbial cells carry out their life processes of growth independently.
D) Microbial cells exist as single cells.
Answer: A

2) Basic microbiology can be used to 2) _____
A) probe the fundamental processes of life.
B) model our understanding of cellular processes in multicellular organisms, including humans.
C) study characteristics of cells of multicellular organisms.
D) do all of the above.
Answer: D

3) Applied microbiology deals with important practical problems in 3) _____
A) medicine. B) industry. C) agriculture. D) all of the above.
Answer: D

4) The largest mass of living material on Earth comes from 4) _____
A) plants. B) microorganisms.
C) plants and animals together. D) animals.
Answer: B

5) Differential selection and reproduction of phenotypes occurs during a process called 5) _____
A) transformation. B) growth.
C) cellular differentiation. D) evolution.
Answer: D

6) In what/which domain(s) of life is/are microorganisms represented? 6) _____
A) Bacteria B) Archaea C) Eukarya D) all of the above
Answer: D

7) A specific molecule, used especially by evolutionary biologists, that is unique to a particular taxonomical group is called a 7) _____
A) genome. B) biomarker.
C) metabolic tracer. D) taxon.
Answer: B

8) Protein catalysts involved in the acceleration of the rate of chemical reactions are called 8) _____
A) enzymes. B) catalytic converters.
C) evolutionary molecules. D) growth agents.
Answer: A

9) Regarding early life on Earth, 9) _____
A) microbial life, plant life, and animal life all appeared at about the same time.
B) microbial life existed long before animals but has been around for about the same amount of time as plants.
C) microbial life existed for billions of years before plant and animal life.
D) it is impossible to determine which type of life first appeared.

Answer: C

10) Most prokaryotic cells reside 10) _____
A) in and on nonprokaryotic organisms (including humans and other animals).
B) in the oceanic and terrestrial subsurfaces.
C) in lakes, rivers, and oceans.
D) on Earth's surface.

Answer: B

11) The person who described the "wee animalcules" was 11) _____
A) Louis Pasteur. B) Ferdinand Cohn.
C) Robert Hooke. D) Antoni van Leeuwenhoek.

Answer: D

12) Fannie Hesse is credited with giving _____ the idea to use agar as a solidifying agent. 12) _____
A) Sergei Winogradsky B) Robert Koch
C) Louis Pasteur D) Ferdinand Cohn

Answer: B

13) Which of the following is/are characteristic of cellular organisms? 13) _____
A) metabolism B) communication
C) regeneration and reproduction D) all of the above

Answer: D

14) Which of the following is NOT a major ecosystem? 14) _____
A) atmospheric
B) terrestrial
C) aquatic
D) other organisms, such as plants and animals

Answer: A

15) Which statement is TRUE? 15) _____
A) Populations are assemblages of habitats.
B) Populations are assemblages of microbial communities.
C) Habitats are assemblages of microbial communities.
D) Microbial communities are assemblages of populations.

Answer: D

16) Louis Pasteur developed the vaccine(s) for 16) _____
A) rabies. B) anthrax. C) fowl cholera. D) all of the above.

Answer: D

17) The discovery of antibiotics and other important chemicals led to the field of 17) _____
A) agricultural microbiology. B) aquatic microbiology.
C) marine microbiology. D) industrial microbiology.

Answer: D

18) Microbial sterilization is used to 18) _____
A) decrease the possibility of contaminants growing in a culture.
B) kill bacteria but not necessarily viruses or other microbes.
C) clean a work area.
D) kill all microbes in or on objects.

Answer: D

19) Transparent double-sided dishes used for growing microbes are most commonly called 19) _____
A) baker dishes. B) culture medium plates.
C) Petri dishes. D) sterilization plates.

Answer: C

20) Microbes playing a role in nitrogen fixation in plants live in _____, while those playing a role in the digestive tract of certain herbivores live in _____. 20) _____
A) rumens / nodules B) fortrans / rumens
C) nodules / fortrans D) nodules / rumens

Answer: D

21) Which of the following is NOT an accomplishment of Louis Pasteur? 21) _____
A) determined that the alcohol-making process was mediated by microbial fermentation and thus refuted the theory of spontaneous generation
B) developed the first rabies vaccine and treated thousands of individuals
C) developed heat sterilization techniques that involved the creation of a specialized swan-necked flask
D) developed enrichment culture techniques

Answer: D

22) The theory of spontaneous generation was refuted by the work of 22) _____
A) Robert Hooke. B) Louis Pasteur.
C) Robert Koch. D) Antoni van Leeuwenhoek.

Answer: B

23) A Pasteur flask has a(n) 23) _____
A) double neck so two substances may be added at the same time.
B) swan neck to prevent particulate matter from getting into the main body of the flask.
C) secondary opening at the base to allow for drainage.
D) inverted upper edge to prevent spillage while swirling.

Answer: B

24) Robert Koch's greatest accomplishment in the field of medical bacteriology was with 24) _____
A) *Mycobacterium tuberculosis*. B) *Bacillus subtilis*.
C) *Bacillus cereus*. D) *Escherichia coli*.

Answer: A

25) A pure culture 25) _____
A) is made of a clearly defined chemical medium.
B) is a population of identical cells.
C) is sterile.
D) was cultured for a certified stock culture.
Answer: B

26) Martinus Beijerinck was the first to isolate 26) _____
A) certain sulfate-reducing bacteria.
B) certain nitrogen-fixing root nodule bacteria.
C) green algae.
D) all of the above.
Answer: D

27) Chemolithotrophy involves 27) _____
A) reduction of organic compounds.
B) oxidation of organic compounds.
C) oxidation of inorganic compounds.
D) metabolic autotrophy.
Answer: C

28) Developments in the fields of immunology and medical microbiology were practical extensions of the work of 28) _____
A) Robert Koch.
B) Antoni van Leeuwenhoek.
C) Joseph Lister.
D) Sergei Winogradsky.
Answer: A

29) Microbial control in wastewaters would most logically be a part of 29) _____
A) microbial genetics.
B) bacterial energetics.
C) microbial technology.
D) aquatic microbiology.
Answer: D

30) Robert Koch contributed to the field of microbiology by being the first person to 30) _____
A) use agar as a solidifying agent in growth media.
B) formulate four postulates for definitively linking a specific microorganism to a specific disease.
C) develop the tuberculin test.
D) all of the above.
Answer: D

31) The science of grouping and classifying microorganisms is known as 31) _____
A) microbial systematics.
B) microbial physiology.
C) metabolomics.
D) proteomics.
Answer: A

32) Mycobacterium tuberculosis is very difficult to stain because of the 32) _____
A) large amounts of a waxy lipid present in its cell wall.
B) presence of ribosomes in the cytoplasm.
C) location of the DNA within the cell.
D) lack of a cell wall.
Answer: A

33) Louis Pasteur's most famous success was his work on 33) _____
A) optical isomers. B) fermentation in the winemaking process.
C) *Mycobacterium tuberculosis*. D) the rabies vaccine.
Answer: D

34) Microorganisms play key roles in the cycling of important nutrients in plant nutrition, particularly those of 34) _____
A) carbon. B) sulfur.
C) carbon, nitrogen, and sulfur. D) nitrogen.
Answer: C

35) Microbial ecology is the study of 35) _____
A) microorganisms in their natural environments.
B) the grouping and classifying of microorganisms.
C) the diversity and activities of marine microorganisms.
D) microbial processes in the soil that benefit plant growth.
Answer: A

36) The structure that confers structural strength on the cell is known as the 36) _____
A) cell wall. B) ribosome.
C) cytoplasmic membrane. D) cytoplasm.
Answer: A

37) Which part of the human body does not contain a significant normal microbial flora? 37) _____
A) large intestine B) stomach C) skin D) oral cavity
Answer: B

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

38) Without microorganisms, all higher life forms on Earth would cease to exist. 38) _____
Answer: True False

39) Most microorganisms are pathogenic. 39) _____
Answer: True False

40) All microorganisms require molecular oxygen to carry on life functions. 40) _____
Answer: True False

41) Metabolism is common to all cellular organisms. 41) _____
Answer: True False

42) According to our present understanding, each of the major domains has what is known as its own universal ancestor. 42) _____
Answer: True False

43) Microbiology as a distinct science did not develop until the eighteenth century. 43) _____
Answer: True False

44) The environment in which a microbial population lives is its habitat. 44) _____
Answer: True False

45) Differentiation occurs only in multicellular organisms. 45) _____

Answer: True False

46) The discipline of microbiology is intimately associated with biochemistry and genetics, because cells are both biochemical catalysts and genetic coding devices. 46) _____

Answer: True False

47) Smallpox is a major killer in parts of the developing world. 47) _____

Answer: True False

48) Sergei Winogradsky worked with bacteria involved in cycling nitrogen and sulfur. 48) _____

Answer: True False

49) *Treponema pallidum,* a bacterium associated with syphilis, is not considered a pathogen because to date it remains unculturable in the lab, and, therefore, Koch's postulates are unable to be fulfilled. 49) _____

Answer: True False

50) Marine microorganisms likely control many important global parameters, including climate and atmospheric chemistry. 50) _____

Answer: True False

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

51) A microbial cell's membrane is considered _____, because its internal constituents are maintained within the cell, however it also imports and exports other molecules in response to its environment. 51) _____

Answer: semi-permeable

52) Some microorganisms can undergo _____ in which various cell types can become specialized and arise from one parent cell type. 52) _____

Answer: cellular differentiation

53) Cyanobacteria and purple bacteria both obtain energy from light, however only the _____ are capable of releasing _____. 53) _____

Answer: cyanobacteria / oxygen

54) The process whereby microorganisms are used to help clean up pollution created by human activities is known as _____. 54) _____

Answer: bioremediation

55) An ecosystem could be defined as _____ along with their _____. 55) _____

Answer: living organisms (biotic) / chemical and physical environments (abiotic)

56) Robert Koch received the 1905 Nobel Prize for Physiology or Medicine for _____. 56) _____

Answer: his contributions on tuberculosis

57) The three major bioenergy products of microorganisms are _____, _____, and _____. 57) _____

Answer: biodiesel / methane / ethanol (any order)

58) Microbial biochemistry involves the discovery of _____ and the _____. 58) _____

Answer: microbial enzymes / chemical reactions they perform

59) DNA sequencing to study organisms' entire nucleotide sequences initially brought about the field of _____, which has itself spawned the subdisciplines of _____ and _____ that represent more functional-based approaches. 59) _____

Answer: genomics / proteomics / metabolomics (second and third in either order)

60) The _____ is the fundamental unit of life. 60) _____

Answer: cell

61) The disease anthrax is caused by the pathogenic bacterium _____, which produces heat-resistant structures known as _____. 61) _____

Answer: *Bacillus anthracis* / endospores

62) Groups of cells derived from a single parent cell by successive cell divisions are known as _____ and which live in environments known as _____. 62) _____

Answer: (microbial) populations / (microbial) habitats

63) The first documented description of a microorganism was of a _____ by _____. 63) _____

Answer: mold / Robert Hooke

64) _____ produced by microbial fermentation of glucose from sugarcane or cornstarch is becoming a more important component of biofuels in the United States, and specialized _____ microbiologists are needed to make this a commercially available product. 64) _____

Answer: Ethanol / industrial

65) _____ was the first to describe microorganisms, while _____ was the first person to see bacteria. 65) _____

Answer: Robert Hooke / Antoni van Leeuwenhoek

66) A population of identical cells is known as a(n) _____. 66) _____

Answer: pure culture

67) _____ described the first virus and the basic principles of virology. 67) _____

Answer: Martinus Beijerinck

68) The discoveries of Martinus Beijerinck and Sergei Winogradsky led to practical advances in the field of _____. 68) _____

Answer: agricultural microbiology

69) Bioremediation _____ by introducing pollutant-consuming microorganisms or specific nutrients that help microorganisms degrade pollutants. 69) _____

Answer: accelerates the natural cleanup process

70) _____ was the first to identify a new form of autotrophy in which energy is obtained from oxidizing inorganic compounds called _____. 70) _____

Answer: Sergei Winogradsky / chemolithotrophy

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

71) Explain the nature and function of an enrichment culture.

Answer: Answers will vary, but an enrichment culture uses media, chemicals, or culture conditions to select for or enhance specific characteristics of an organism.

72) Why is it incorrect to say that an object is partially sterile?

Answer: Answers will vary, but sterile means the absence of living organisms. Something is either sterile or it is not.

73) Microbes were first formally observed during the mid-1600s, but the cell theory was not enunciated until 1839. Write a brief essay explaining why microbiology did not become a formally recognized science until Louis Pasteur's and Robert Koch's time.

Answer: Answers will vary, but a theme should be the lack of powerful microscopy tools.

74) List three contributions of Ferdinand Cohn to the development of microbiology.

Answer: Answers could possibly include: founding bacteriology as a separate science, studying *Beggiatoa*, discovering the genus *Bacillus* (along with its endospore formation and its life cycle), devising methods to prevent contamination, and founding a major scientific journal.

75) Compare and contrast the works of Louis Pasteur and Robert Koch in terms of both applied and basic science.

Answer: Answers will vary, but should highlight the differences between basic scientific research in which fundamental ideas are discovered opposed to the usage of microbiological principles to solve larger questions. Examples of Pasteur's basic science contributions are his work showing that fermentation was mediated by microorganisms and the preferential metabolism of particular optical isomers by microbes. Pasteur also applied his ideas to develop sterilization techniques. Robert Koch focused more on the application of microbiology to identify the cause of tuberculosis by developing pure culturing techniques and the four postulates to link microbes to a disease.

76) Explain why microbial cells are excellent models for understanding cell function in higher organisms.

Answer: Answers will vary but should include commonality of function, biochemical and genetic similarities, and ease and speed with which they can be grown in large quantities.

77) Compare and contrast the leading causes of death in 1900 with the leading causes of death today. What roles have microbiologists played in the dramatic changes that are evident?

Answer: Answers will vary, but a focus should be that pathogens that killed people in the early 1900s are now treatable due to knowledge learned from microbiologists.

78) Explain how you would use Robert Koch's postulates to determine that *Streptococcus pyogenes* is the causative agent of streptococcal pharyngitis ("strep throat").

Answer: Answers will vary but will need to detail how *S. pyogenes* will be subjected to all four postulates.

79) The text states that antibiotics are derived from microorganisms. What is the benefit to an antibiotic-producing microorganism of producing an antibiotic in its natural habitat?

Answer: Answers will vary, but it must first be stated the antibiotic-producing microbe would need to be resistant to the antibiotic. This should then follow into a discussion on how antibiotic production could be viewed as a way to persist in the environment, such as maintaining dominance in a community over others.

80) Describe beneficial and harmful ways in which microorganisms interact with agricultural crops.

Answer: Certain microbes are beneficial to crops when they produce nutrients (e.g., NH_4^+, SO_4^{2-}) usable by a crop from a substrate that was unusable. Other microbes can cause diseases in plants, much like pathogens cause disease in humans.

81) Provide evidence supporting the statement that an ecosystem is controlled by microbial activities.

Answer: Answers will vary, but one example could be oxygen depletion, where a loss of oxygen would then favor anaerobic microorganisms.

82) Explain why only anaerobic bacteria inhabited Earth for the first two billion years of its existence.

Answer: Answers will vary, but the key idea is an anoxic environment will not allow aerobic organisms to survive.

83) How would the presence of endospores in Louis Pasteur's nutrient solutions have affected his conclusions about spontaneous generation?

Answer: Answers will vary, but ultimately this could have confounded Pasteur if the endospores sometimes went into a vegetative growth phase and other times no growth was observed.

84) Using specific examples, explain why it is sometimes impossible to satisfy Robert Koch's postulates.

Answer: Answers will vary, but one issue is the consideration for a model animal host that will react to the (human) pathogen in the same manner as in a human host. For example, a chicken would not show flu-like symptoms when infected with the influenza virus.

85) Explain why infectious diseases are much less lethal in developed countries than in underdeveloped countries.

Answer: Answers will vary but should emphasize ways in which increased knowledge about microbial pathogenesis has influenced preventative care (e.g., sanitation) and treatment (e.g., antimicrobial drugs).

86) Describe two capabilities of microbes that exemplify their dynamic nature.

Answer: Answers could possibly include cell-cell communication, ability to move (motility), and exchange of materials (any two).

87) Compare and contrast the functions microbes serve in the digestive systems of both humans and rumens (e.g., cattle).

Answer: Answers will vary but should focus on humans having a high cell localized density in the colon (large intestine), whereas rumens have higher microbial populations in the rumen.