Exam

Name_____

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

1) Antoni van Leeuwenhoek was the first person in history to 1) _____
A) use a magnifying glass.
B) use the germ theory of disease.
C) disprove spontaneous generation.
D) develop a taxonomic system.
E) view microorganisms and record these observations.
Answer: E

2) Which of the following microbes are likely to be the swiftly moving "animalcules" observed by Leeuwenhoek in pond water? 2) _____
A) fungi
B) protozoa
C) viruses
D) fungi and algae
E) algae
Answer: B

3) Which of the following statements about fungi is INCORRECT? 3) _____
A) Molds are multicellular.
B) Fungi have a cell wall.
C) Fungi are photosynthetic.
D) Yeasts are unicellular.
E) Fungi are eukaryotes.
Answer: C

4) Which of the following is an accurate description of viruses? 4) _____
A) They are visible with a light microscope.
B) They are acellular obligatory parasites.
C) They are typically about the size of prokaryotic cells.
D) They are the smallest known cells.
E) They are composed of protein only.
Answer: B

5) Which of the following is an INCORRECT pairing? 5) _____
A) viruses; acellular parasites
B) fungi; cell walls
C) prokaryotes; no nuclei
D) protozoa; multicellular
E) algae; aquatic and marine habitats
Answer: D

6) A tiny (less than 2 micrometers) new organism is discovered living in a boiling hot "mud pot" (a type of mud spring). It is most likely a member of the 6) _____
A) protozoa. B) algae. C) viruses. D) archaea. E) fungi.
Answer: D

7) Parasitic worms, even meters–long tapeworms, are studied in microbiology because 7) _____
A) the Gram stain can be used to identify them.
B) they are parasites.
C) no one else wants to study them.
D) diagnosis usually involves microscopic examination of patient samples.
E) Leeuwenhoek first discovered them.

Answer: D

8) Which of the following is NOT a characteristic of protozoa? 8) _____
A) They are all photosynthetic.
B) Most exhibit asexual reproduction.
C) They frequently possess cilia or flagella.
D) They are single–celled organisms.
E) They are eukaryotic organisms.

Answer: A

9) The microbes commonly known as _____ are single–celled eukaryotes that are generally motile. 9) _____
A) protozoa B) bacteria C) viruses D) archaea E) fungi

Answer: A

10) Microorganisms characterized by the absence of a nucleus are called 10) _____
A) eukaryotes.
B) viruses.
C) pathogens.
D) fungi.
E) prokaryotes.

Answer: E

11) Louis Pasteur demonstrated that fermentation to produce alcohol is caused by 11) _____
A) facultative anaerobes.
B) archaea.
C) prokaryotes.
D) aerobes.
E) obligate parasites.

Answer: A

12) Which of the following questions largely stimulated the research of microbes during what is known as the Golden Age of Microbiology? 12) _____
A) How should living organisms be classified?
B) How do genes work?
C) How are microbes related?
D) What causes disease, and is spontaneous generation of microbes possible?
E) How can microorganisms be seen?

Answer: D

13) Aristotle was an early natural philosopher who formulated the 13) _____
A) theory of spontaneous generation (abiogenesis).
B) scientific method.
C) germ theory of disease.
D) theory of "magic bullets."
E) theory of natural selection.

Answer: A

14) Which of the following scientists provided evidence in favor of the concept of spontaneous generation? 14) _____
A) Needham
B) Pasteur
C) Redi
D) Buchner
E) Spallanzani

Answer: A

15) Which of the following was NOT an aspect of Pasteur's experiments to disprove spontaneous generation? 15) _____
A) He boiled the infusions to kill any microbes present.
B) The necks of the flasks he used were bent into an S–shape.
C) The flasks he used were sealed with corks.
D) The flasks were free of microbes until they were opened.
E) The flasks were incubated for very long periods of time.

Answer: C

16) What is the correct order for the steps in the scientific method? 16) _____
I. Conduct experiment.
II. Develop a hypothesis.
III. Analyze results.
IV. Accept or reject hypothesis.
A) I, II, III, IV
B) I, III, II, IV
C) IV, III, II, I
D) II, I, III, IV
E) There is no specific order required.

Answer: D

17) What must one have before designing and conducting experiments? 17) _____
A) a theory
B) popular opinion
C) a hypothesis
D) a complete set of data
E) scientific law

Answer: C

18) Pasteur's experiments on fermentation laid the foundation for 18) _____
A) immunology.
B) abiogenesis.
C) antisepsis.
D) industrial microbiology.
E) epidemiology.
Answer: D

19) Which of the following is NOT an observation Pasteur made concerning the fermentation of grape juice? 19) _____
A) Yeast can grow in sealed or open flasks of grape juice.
B) Yeast can grow with or without oxygen.
C) Pasteurization kills yeast to prevent spoilage of grape juice.
D) Yeast cells can grow and reproduce in grape juice.
E) Some bacteria may produce acid in grape juice.
Answer: C

20) Who among the following may be considered the Father of Microbiology in part because of his careful application of the scientific method to many problems in microbiology? 20) _____
A) Edward Jenner
B) Robert Koch
C) Eduard Buchner
D) Louis Pasteur
E) Lazzaro Spallanzani
Answer: D

21) Who demonstrated that fermentation could occur in the absence of intact cells? 21) _____
A) Woese B) Koch C) Pasteur D) Buchner E) Lister
Answer: D

22) Which of the following statements concerning Koch's postulates is FALSE? 22) _____
A) The suspected pathogen may not be present in all cases of the disease being studied.
B) Koch's postulates cannot be used to demonstrate the cause of all diseases.
C) Koch's postulates involve the experimental infection of susceptible hosts.
D) All of Koch's postulates must be satisfied before an organism can be shown to cause a particular disease.
E) A suspected pathogen must be able to be grown in the laboratory.
Answer: A

23) Robert Koch's contributions to the foundations of modern microbiology include 23) _____
A) demonstrating that hand washing can reduce the spread of disease.
B) developing methods for isolation and identification of bacteria.
C) demonstrating the role of microbes in fermentation.
D) demonstrating certain chemicals are toxic to bacteria but not humans.
E) providing evidence for rejecting the theory of spontaneous generation.
Answer: B

24) What was the first disease shown to be bacterial in origin? 24) _____

A) malaria
B) yellow fever
C) cholera
D) anthrax
E) tuberculosis

Answer: D

25) What is the correct order for the application of Koch's postulates? 25) _____

I. Inoculate suspect agent into test subject and observe that subject develops disease of interest.
II. Isolate and culture suspect agent in the laboratory.
III. Find suspect agent is every case of disease of interest but not in healthy hosts.
IV. Recover and isolate suspect agent from test subject.

A) III, II, I, IV B) IV, I, III, II C) III, I, IV, II D) I, II, III, IV E) IV, I, II, III

Answer: A

26) Identification of bacteria in the laboratory usually begins with the _____ for placement in one of two large groups of bacteria. 26) _____

A) Ehrlich magic test
B) Koch's stain
C) Petri stain
D) Gram stain
E) Pasteur fermentation test

Answer: D

27) Which of the following individuals pioneered the use of chemicals to reduce the incidence of infections during surgery? 27) _____

A) Semmelweis
B) Nightingale
C) Ehrlich
D) Snow
E) Lister

Answer: E

28) Semmelweis advocated hand washing as a method of preventing which of the following diseases? 28) _____

A) smallpox
B) cholera
C) anthrax
D) syphilis
E) puerperal fever

Answer: E

29) John Snow's research during a cholera outbreak in London laid the foundation for which of the following branches of microbiology? 29) _____

A) infection control, epidemiology, and immunology
B) both infection control and epidemiology
C) epidemiology only
D) immunology only
E) infection control only

Answer: B

30) The work of Lister, Nightingale, and Semmelweis all contributed to controlling infectious disease by 30) _____
A) determining the taxonomic relationships among microbes.
B) developing techniques for isolating pathogens.
C) developing methods for reducing health care associated infections (HAI).
D) identifying the sources of infectious agents.
E) developing vaccines.

Answer: C

31) All of the following were involved in developing the germ theory of disease EXCEPT 31) _____
A) Pasteur.
B) Pauling.
C) Koch.
D) Snow.
E) Fracastoro.

Answer: B

32) The term that literally means "against putrefaction" is 32) _____
A) prokaryote.
B) abiogenesis.
C) chemotherapy.
D) recombinant technology.
E) antisepsis.

Answer: E

33) The study of the occurrence, distribution, and spread of disease is known as 33) _____
A) biotechnology.
B) epidemiology.
C) biochemistry.
D) immunology.
E) serology.

Answer: B

34) Edward Jenner's efforts to prevent smallpox provided the foundation for the field of 34) _____
A) chemotherapy.
B) etiology.
C) epidemiology.
D) molecular biology.
E) immunology.

Answer: E

35) The first true vaccine protected against disease caused by a(n) _____ pathogen. 35) _____
A) bacterial B) archaeal C) fungal D) viral E) protozoal

Answer: D

36) Paul Ehrlich used chemotherapy to treat 36) _____
A) cholera. B) syphilis. C) cancer. D) anthrax. E) smallpox.

Answer: B

37) Whose search for chemicals that would kill microbes without harming humans was the foundation for chemotherapy? 37) _____

A) Gram B) Pasteur C) Lister D) Koch E) Ehrlich

Answer: E

38) Who discovered penicillin? 38) _____

A) Pasteur B) Ehrlich C) Fleming D) Domagk E) Kitasato

Answer: C

39) What scientist first hypothesized that gene sequences could provide new insights into evolutionary relationships among all organisms (including microbes)? 39) _____

A) Avery B) Kluyver C) Ehrlich D) Woese E) Pauling

Answer: E

40) According to Kluyver and van Niel, which of the following are TRUE of basic biochemical reactions? 40) _____

A) They primarily involve the transfer of electrons and ions.
B) Basic biochemical reactions shared by all living things primarily involve transfer of electrons and hydrogen ions.
C) There are an unlimited number of them.
D) They primarily involve transfers of chemical groups.
E) They are shared by all living things.

Answer: B

41) Inserting a gene from the hepatitis B virus into yeast so that the yeast produces a viral protein is an example of 41) _____

A) microbial genetics.
B) etiology.
C) immunology.
D) gene therapy.
E) genetic engineering.

Answer: E

42) Work by _____ laid the foundations of the field of environmental microbiology. 42) _____

A) Lister and Semmelweis
B) Beijerinck and Winogradsky
C) Koch and Pasteur
D) Redi and Spallanzani
E) Pauling and Woese

Answer: B

43) The term for the use of microorganisms to restore damaged environments is 43) _____

A) bioremediation.
B) ecology.
C) serology.
D) epidemiology.
E) chemotherapy.

Answer: A

44) The term _____ involves the study of the blood components that fight infection. 44) _____

A) bioremediation
B) antisepsis
C) chemotherapy
D) serology
E) etiology

Answer: D

45) Recent estimates of the number of microbes on the planet have expanded almost exponentially, but the number of microorganisms isolated in the lab has not increased at the same rate. How can microbiologists justify the higher estimates if they cannot isolate and grow the microbes in the lab? 45) _____

A) The huge numbers of diseases without apparent causative agents indicate there are large numbers of unidentified pathogens.
B) Detection of novel enzymes indicates the existence of unidentified microbes.
C) Previous estimates of the abundance of microbes cannot account for the detectable biomass in most environments.
D) New technologies make it possible to detect the nucleic acid sequences of previously unknown organisms.
E) Much more powerful microscopes have made it possible to observe and identify huge numbers of microbes that cannot be isolated.

Answer: D

46) The control of infectious disease remains challenging a century after the understanding of infectious disease began. What contributes to the continuing challenge? 46) _____

A) emerging diseases
B) rapidly growing estimates of the diversity of microbes
C) creating microbes using recombinant DNA technology
D) both drug–resistant pathogens and emerging diseases
E) developing resistance to antimicrobial agents

Answer: D

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

47) Microbiologists study only single–celled organisms. 47) _____

Answer: True ✓ False

48) A microbe with a cell wall and no internal membrane enclosing the DNA is a prokaryote. 48) _____

Answer: ✓ True False

49) Lazzaro Spallanzani was the first scientist to provide evidence disproving the spontaneous generation of microorganisms. 49) _____

Answer: ✓ True False

50) Louis Pasteur is considered the Father of Microbiology because of the many carefully conducted experiments and observations he made with microbes. 50) _____

Answer: ✓ True False

51) Fermentation requires the presence of living cells. 51) _____

Answer: True ✓ False

52) Koch's postulates can be used only to determine the causes of infectious diseases. 52) _____

Answer: True False

53) Christian Gram devised a staining technique that divides all bacteria into two groups. 53) _____

Answer: True False

54) Joseph Lister reduced the incidence of wound infections in health care settings by using chlorinated lime water. 54) _____

Answer: True False

55) Chemotherapy is the application of weakened pathogens to prevent disease. 55) _____

Answer: True False

56) Gene therapy is a modern approach to preventing infectious disease. 56) _____

Answer: True False

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

57) The amateur scientist (Koch/Leeuwenhoek/Pasteur) made his own microscopes and first reported the existence of microbes. 57) _____

Answer: Leeuwenhoek

58) The (alga/fungi/protozoa) are non–motile eukaryotes with cell walls that are not photosynthetic and may be multicellular. 58) _____

Answer: fungi

59) A cell that contains a nucleus is called a(n) (prokaryotic/archaeal/eukaryotic) cell. 59) _____

Answer: eukaryotic

60) The production of wine from grape juice is the result of (metabolism/fermentation/abiogenesis). 60) _____

Answer: fermentation

61) Spallanzani's experiments contradicted the experiments of (Needham/Redi/Pasteur) on spontaneous generation. 61) _____

Answer: Needham

62) A scientist conducts experiments to test a(n) (observation/hypothesis/theory). 62) _____

Answer: hypothesis

63) The work of (Buchner/Ehrlich/Pasteur/Winogradsky) is considered the foundation of the field of biochemistry. 63) _____

Answer: Buchner

64) Microbes that cause infectious disease are called (pathogens/germs/viruses). 64) _____

Answer: pathogens

65) Ignaz Semmelweis demonstrated the importance of (antisepsis/vaccination/washing) as a means of preventing disease transmission. 65) _____

Answer: washing

66) The use of chemicals to treat diseases such as bacterial infections is called (gene therapy/chemotherapy/serology). 66) _____

Answer: chemotherapy

67) Research done in Robert Koch's laboratory laid the foundation for (epidemiology/immunology/etiology), the study of the body's defenses against disease. 67) _____

Answer: immunology

68) Organisms such as bacteria that can convert atmospheric nitrogen into nitrate are often studied in (environmental/bioremediation/ecologic) microbiology. 68) _____

Answer: environmental

69) The development of molecular biology has made possible the application of (genome sequencing/gene sequences/gene sequencing) to provide a better understanding of the relationships between organisms. 69) _____

Answer: gene sequencing

70) A (colony/habitat/biofilm) is a community of microbes growing on surfaces. 70) _____

Answer: biofilm

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

71) You are a young scientist who has just learned about one of the hot topics in microbiology, biofilms. One aspect of the interest in biofilms is that the microbes living within biofilms appear to behave and function differently from their counterparts not living in a biofilm. Devise a way to explore the idea. (Do not focus on the technical details of how this might be accomplished.)

Answer: Many answers are possible. A good answer should have a clear statement of hypothesis and an experimental design that reflects the hypothesis and will provide interpretable quantitative results. An excellent answer may include projections of possible outcomes and/or alternative hypotheses.

72) Use the basic steps of the scientific method to describe Pasteur's experiments to investigate spontaneous generation.

Answer: The observation that life seemed to appear from non–life led some scientists to believe in the theory of spontaneous generation. However, Pasteur among others believed in biogenesis: that life must come from life. The question Pasteur hoped to answer was "Where do microbes come from?" (step 1). Pasteur's hypothesis (step 2) was that the "parents" of microbes were present in the air on dust particles. In his experiments (step 3) he used swan–necked flasks, which were designed to prevent microbes from entering the sterile broth inside them. He observed that the broth remained sterile in the control flask even though air could move into and out of the flask. The experimental flasks were also swan–necked, but they were tilted to allow the dust that had settled to enter the flask. The control flasks stayed sterile, and the experimental flasks became cloudy. These observations led Pasteur to accept his hypothesis (step 4). He concluded that the microbes came from the dust and that spontaneous generation was therefore not a valid theory.

73) Biotechnology can be said to have ancient roots. Explain.

Answer: Biotechnology is the use of microbes to yield beneficial products. Humans have used microbes to their benefit for millennia in producing beer and wine, which were often safer to drink than the available water, and in preserving foods. Examples of the latter include the production of wine, which essentially preserved fruit juices, and of cheese and yogurt, which extended the storage life of milk products. Soy sauce and other fermented sauces were also preserved by fermentation and were later shown to enhance the flavors of certain foods.

74) Explain how the discipline of biochemistry grew out of the science of microbiology.

Answer: Some of the first experiments in biochemistry are attributed to Louis Pasteur in his research on the causes of fermentation. His research was extended by Eduard Buchner, who showed that enzymes produced by microbial cells are responsible for the phenomenon of fermentation. Later, in the early 20th century, Kluyver and van Niel advocated the use of microbes in research on basic biochemical reactions, which they maintained are common to all living things. Further advances in biochemistry were made as microbiologists such as Beadle and Tatum and Avery and his colleagues explored the nature of the genetic material and its function using microorganisms as model systems.

75) Recent news stories have reported on the "microbiome" of the human body. The reports include statements about the abundance of the microbes in and on the human body ("They outnumber our cells 10 to 1") and that most of these microbes are unknown to science. Discuss how microbiologists can have confidence in these apparently conflicting statements.

Answer: Molecular techniques have advanced to the point that it is possible to detect and visualize microorganisms without having to isolate them in the lab. DNA sequence detection techniques in particular are useful for identifying the presence of microbes that cannot be isolated in the lab (are "unculturable"). This in turn has made it possible to detect the presence of many previously unsuspected microbes. Some of the techniques also provide a means of roughly quantifying the numbers of each type of microbe. Thus it is possible for scientists to confidently discuss the huge numbers of microbes resident in and on the human body without having to isolate and grow each type.