

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

- 1) Which of the following statements is true? 1) \_\_\_\_\_
- A) Picking which type of media format to use depends only on the space available.
  - B) Picking which type of media to use depends on how much money you willing to spend.
  - C) Media for bacterial growth only comes in a few varieties.
  - D) Agar is used as a solidifying agent for bacterial culture.
  - E) Scientists were not able to grow bacteria in the lab until the creation of the Petri dish.

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

- 2) Proper hand-washing technique can remove normal microbiota. 2) \_\_\_\_\_

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- 3) Which of the following could be used as evidence for spontaneous generation? 3) \_\_\_\_\_
- A) Uncovered meat will give rise to maggots.
  - B) Gauze-covered meat will not give rise to maggots.
  - C) Flies lay eggs that develop into maggots.
  - D) The broth in Pasteur's S-necked flasks did not spoil.
  - E) Shaking Pasteur's S-necked flasks did spoil the broth.

- 4) The acid-fast stain is an important diagnostic tool for detecting the causative agent(s) of 4) \_\_\_\_\_
- A) gonorrhea.
  - B) Lyme disease and necrotizing fasciitis.
  - C) plague.
  - D) malaria.
  - E) tuberculosis and leprosy.

- 5) A biological safety cabinet minimizes the chances of contaminating cultures by all of the following except 5) \_\_\_\_\_
- A) maintaining a specific flow of filtered air.
  - B) consistent flame sterilization on the inside surfaces.
  - C) limiting access to inside the cabinet.
  - D) regular surface cleaning with an antimicrobial solution.
  - E) readily being decontaminated using UV light.

- 6) Which of the following is true about bioremediation? 6) \_\_\_\_\_
- A) Nitrogen, sulfur, phosphate, and sometimes iron supplements are added to the spill zone to encourage microbial growth.
  - B) The Environmental Protection Agency documents a handful of chemical spills per year in the United States alone.
  - C) A mix of bacteria, archaea, and fungi species is used to seed the spill zone.
  - D) Bioremediation never harms the environment.
  - E) Coagulators are used to condense the spill.

- 7) Robert Koch helped establish the germ theory of disease by discovering that anthrax was caused by a disease. After he isolated and purified the same bacteria from several diseased animals, what would be the next step in order to show that this bacteria caused anthrax? 7) \_\_\_\_\_
- A) perform physiological testing
  - B) culture the bacteria on Petri dishes
  - C) introduce the bacteria into a new mouse to see if it established the same infection
  - D) find out if antibiotics treat the diseased animals
  - E) visualize the bacteria with an electron microscope

- 8) When do opportunistic pathogens tend to cause disease? 8) \_\_\_\_\_
- A) after the host is already infected with a different pathogen
  - B) when the host is old
  - C) when the host is young
  - D) when the host is weakened
  - E) when the host didn't wash with soap

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

- 9) Fixation adheres the sample to the slide, so that it is not as easily washed away during the staining process, but does not kill most of the cells in the specimen so that they can be clearly viewed. 9) \_\_\_\_\_

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- 10) All of the following can make interpreting the Gram stain difficult except 10) \_\_\_\_\_
- A) testing bacteria that have a waxy cell wall.
  - B) testing bacteria with especially resistant cell walls.
  - C) the culture is more than 48 hours old and contains damaged cells.
  - D) the culture is between 24 and 48 hours old.
  - E) testing bacteria that are forming endospores.

- 11) \_\_\_\_\_ showed that biogenesis is responsible for the propagation of life. 11) \_\_\_\_\_
- A) Louis Pasteur
  - B) Carl Linnaeus
  - C) Robert Hooke
  - D) Joseph Lister
  - E) Antonie van Leeuwenhoek

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

- 12) Florence Nightingale investigated processes for aseptic surgery and her work in the 1860s proved that sterilizing instruments, and sanitizing wounds with carbolic acid encouraged healing and prevented pus formation. 12) \_\_\_\_\_

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- 13) All of the following are or can be produced by microbes except 13) \_\_\_\_\_
- A) electronics like computer memory.
  - B) biofuels like diesel.
  - C) food like chocolate.
  - D) consumer products like biodegradable plastics.
  - E) drugs like penicillin.

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

14) Explain the differences between basic and acidic dyes and how they are used.

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15) Microbes and humans have evolved a variety of \_\_\_\_\_ relationships, including \_\_\_\_\_ where microbes help the host. 15) \_\_\_\_\_

- A) dynamic; commensalism
- B) symbiotic; mutualism
- C) commensal; mutualism
- D) symbiotic; parasitism
- E) symbiotic; commensalism

16) Inference-observation confusion occurs when someone 16) \_\_\_\_\_

- A) jumps to a conclusion.
- B) lies about what happened.
- C) incorrectly assesses a patient.
- D) remembers events wrong.
- E) cannot understand your accent.

17) All of the following involve biofilms except 17) \_\_\_\_\_

- A) inner ear infections.
- B) kidney stones.
- C) endocarditis.
- D) conjunctivitis.
- E) atherosclerosis.

18) The scientific method starts with a(n) 18) \_\_\_\_\_

- A) observation.
- B) hypothesis.
- C) proposal.
- D) prediction.
- E) question.

19) Why can't prokaryotic species be defined as a group of similar organisms that could sexually reproduce together? 19) \_\_\_\_\_

- A) The mating rituals of bacteria have not been studied enough.
- B) Bacteria reproduce asexually.
- C) They can be.
- D) We can't see them in enough detail to tell how similar they really are yet.
- E) Bacteria are all too different to be considered similar.

20) How many principles are there in Koch's postulates of disease? 20) \_\_\_\_\_

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

21) Which of the following is not a microorganism? 21) \_\_\_\_\_

- A) archaea
- B) helminth
- C) bacteria
- D) mosquito
- E) fungi

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

- 22) Knowing the Gram property of a specimen has important clinical implications, including potential pathogenic features of the organism, and what antibiotics might be most effective in combating it. 22) \_\_\_\_\_

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

- 23) \_\_\_\_\_ bacteria can create sticky communities called \_\_\_\_\_, which are made up of single or diverse microbial species. 23) \_\_\_\_\_  
A) Plaque; hangouts  
B) Infectious; flora  
C) Matrix; cavities  
D) Planktonic; biofilms  
E) Pathogenic; quorums

- 24) Which of the following statements is false? 24) \_\_\_\_\_  
A) Immunofluorescence is when fluorochromes bind to a specific target and fluoresce after exposure to UV light.  
B) Fluorochromes can be natural or synthetic.  
C) Scanning electron microscopy provides information about surface structures.  
D) Fluorescence microscopy is when fluorochromes stain a sample so it will fluoresce when exposed to UV light.  
E) Transmission electron microscopy provides information about internal structures.

- 25) When practicing aseptic culturing techniques, it is important to keep all of the following in mind except 25) \_\_\_\_\_  
A) the media used to grow the specimen is sterile.  
B) surrounding surfaces are decontaminated before and after handling cultures.  
C) as long as nothing unintended touches the media, there will be no contamination.  
D) all of the instruments and lab ware that directly touch the specimen is sterile.  
E) gloves and other protecting clothing may be required depending on the specimen being used.

- 26) Which of the following statements is false? 26) \_\_\_\_\_  
A) Resolution is the ability to distinguish two distinct points as separate.  
B) Immersion oil is used to get a better resolution at high-power magnifications.  
C) Immersion oil channels as much light as possible up through the objective lens instead of being bent.  
D) Immersion oil has a lower refractive index than the glass slide to help increase sample clarity.  
E) Ultimately, the resolving power of bright field microscopes is limited by the wavelength of visible light.

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

27) Explain how disruptions in normal microbiota can lead to infections.

28) Explain the differences between a hypothesis, law, and theory.

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

- 29) \_\_\_\_\_ predict what happens, while \_\_\_\_\_ explain how and why something occurs. 29) \_\_\_\_\_  
A) Observations; hypotheses  
B) Theories; laws  
C) Laws; theories  
D) Observations; conclusions  
E) Hypotheses; conclusions
- 30) Aseptic technique can be used for all of the following except 30) \_\_\_\_\_  
A) sterilizing working surfaces.  
B) limiting the spread of diseases.  
C) safely studying microbes in the laboratory.  
D) preventing healthcare-acquired infections.  
E) keeping samples pure for studying.
- 31) Why do electron microscopes have a better resolution versus light microscopes? 31) \_\_\_\_\_  
A) An electron beam has a wavelength of about 1 nm, and resolution improves with smaller wavelengths.  
B) An electron beam has a wavelength of about 800 nm, and resolution improves with larger wavelengths.  
C) The additional steps necessary to prepare the sample for viewing provide the improved resolution.  
D) The lenses, knobs, and strength of the electron beam can all be highly controlled, which also explains why electron microscopes are so expensive.  
E) The lenses used to focus the electron beam are more adjustable than the ones in a light microscope.
- 32) Which of the following does not contribute to shifts in our normal microbiota? 32) \_\_\_\_\_  
A) hormonal changes  
B) our general environment  
C) proper hand-washing technique  
D) age  
E) diet

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

- 33) Simple staining techniques use one dye. 33) \_\_\_\_\_

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

- 34) Which of the following is the correct way to type a scientific name? 34) \_\_\_\_\_  
A) Escherichia Coli  
B) *escherichia coli*  
C) *Escherichia coli*  
D) *Escherichia coli*  
E) escherichia coli

- 35) Which of the following statements about bright field microscopy are true? 35) \_\_\_\_\_
- A) Bright field microscopy has the sample appear as a brighter contrasting image on a dark background.
  - B) Bright field microscopy is great for seeing living samples.
  - C) Bright field microscopy is able to see specimens without natural coloration.
  - D) Bright field microscopy is the simplest and most common form of microscopy.
  - E) Dark field, phase contract, and differential interference contract microscopy are better for observing dead samples.

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

- 36) Only a small minority of microbes are human pathogens. 36) \_\_\_\_\_
- 37) Biofilms allow microbes to coordinate responses within an environment, making the community much more durable than single free-floating bacteria. 37) \_\_\_\_\_

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

- 38) Which of the following individuals does not correctly match with their contribution to microbiology. 38) \_\_\_\_\_
- A) Ignaz Semmelweis: First developed aseptic techniques to decrease mortality rates from childbed fever
  - B) Joseph Lister: Developed the first anesthetic solution for use in surgeries
  - C) Louis Pasteur: Showed that biogenesis is responsible for the propagation of life
  - D) Florence Nightingale: Established the use of aseptic techniques in nursing practices
  - E) Robert Koch: Developed criteria for determining the causative agent of an infectious disease
- 39) All of the following are reasons to classify a new strain of bacteria except 39) \_\_\_\_\_
- A) gene transfers.
  - B) 50% different genetic material.
  - C) mutations.
  - D) take up genetic material from their environment.
  - E) genetic variant.
- 40) What is the order of the taxonomic hierarchy from least specific to most specific? 40) \_\_\_\_\_
- A) domain, phylum, order, kingdom, class, family, genus, species
  - B) class, order, phylum, kingdom, domain, genus, family, species
  - C) domain, order, class, kingdom, phylum, species, family, genus
  - D) species, genus, order, family, class, phylum, kingdom, domain
  - E) domain, kingdom, phylum, class, order, family, genus, species
- 41) Normal microbiota are responsible for all of the following except 41) \_\_\_\_\_
- A) helping us digest foods.
  - B) producing vitamins for us.
  - C) impacting our moods and brain functions.
  - D) training our immune system.
  - E) controlling epigenetic expression.

- 42) Which of the following statements is true about the decolorizing step for the acid-fast stain? 42) \_\_\_\_\_
- A) Acetone-alcohol solution is the decolorizing agent.
  - B) Non-acid-fast bacteria appear bright pink-red at the end of the procedure.
  - C) Over-decolorizing can lead to false-positive results.
  - D) The decolorizing step is the differentiating step.
  - E) Because acid-fast bacteria have a waxy cell wall that resists decolorization by the acetone-alcohol rinse, they appear a deep blue at the end of the procedure.

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

- 43) Robert Hooke refined earlier versions of the microscope and became the first to see bacteria. 43) \_\_\_\_\_

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- 44) Which of the following can be determined using simple stains? 44) \_\_\_\_\_
- A) size, shape and cellular arrangement
  - B) size and shape
  - C) the number and position of flagella
  - D) the presence of capsules
  - E) the presence of endospores

- 45) The goal of the streak plate technique is to 45) \_\_\_\_\_
- A) spread out a thick layer of bacteria and isolate the bacteria that outcompete the rest.
  - B) compare how the shape, color and margin differ in colonies from a pure culture.
  - C) compare all of the colonies on a plate with a mixed culture.
  - D) isolate a pure culture for study from a single colony.
  - E) visualize all of the colonies on a plate from a pure culture.

- 46) Carriers of the sickle-cell gene 46) \_\_\_\_\_
- A) are often found in high concentrations in U.S. cities.
  - B) are more susceptible to contracting malaria.
  - C) have a survival advantage in areas where malaria is common.
  - D) are more likely to die from a malaria infection.
  - E) experience painful changes in nerve cell shape.

## Answer Key

Testname: CH1

- 1) D
- 2) FALSE
- 3) A
- 4) E
- 5) B
- 6) A
- 7) C
- 8) D
- 9) FALSE
- 10) D
- 11) A
- 12) FALSE
- 13) A
- 14) Basic dyes are mildly basic on the pH scale. Being basic means they are positively charged, resulting in the stain being attracted to the negatively charged cell surface of microbes and easily entering cells. Frequently used basic dyes include methylene blue, crystal violet, safranin, and malachite green. Occasionally acidic dyes, such as nigrosin or India ink, are also used. Acidic dyes are negatively charged, so they do not easily enter cells. They stain the background of a specimen in a technique called negative staining. An advantage of negative staining is that it doesn't require heating or chemical fixation, and the dye is not absorbed by the sample. This means the sample has a more true-to-life appearance, with fewer distortions of delicate cellular features.
- 15) B
- 16) A
- 17) D
- 18) E
- 19) B
- 20) D
- 21) D
- 22) TRUE
- 23) D
- 24) A
- 25) C
- 26) D
- 27) When an antibiotic is used, it may kill many types of benign resident bacteria along with the pathogen being targeted. With normal microbiota reduced, opportunistic pathogens are able to establish infections. A common example of this is when a woman takes antibiotics to treat a urinary tract infection (UTI), only to develop a vaginal yeast infection soon after the antibiotic therapy concludes. The yeast *Candida albicans* is an opportunistic pathogen that is usually present in the vagina. Its growth is kept in check by the normal microbiota of the vagina. Thus, when the vaginal normal microbiota is disrupted, the yeast has an opportunity to thrive and cause symptoms. Similarly, diarrhea is a common side effect of antibiotic therapies, likely due to how our gut microbiome is affected.
- 28) A hypothesis is based on prior experience or observation, and is proposed as a potential answer to a specific question. A law is a precise statement, or mathematical formula, that predicts a specific occurrence. Laws only hold true under carefully defined and limited circumstances. By contrast, a theory is a hypothesis that has been proven through many studies with consistent, supporting conclusions. Laws predict what happens, while theories explain how and why something occurs. Unlike a hypothesis, which focuses on a specific problem, theories are comprehensive bodies of work that are useful for making generalized predictions about natural phenomena. Theories unite many different hypotheses and laws.
- 29) C
- 30) A
- 31) A
- 32) C

## Answer Key

Testname: CH1

- 33) TRUE
- 34) C
- 35) D
- 36) TRUE
- 37) TRUE
- 38) B
- 39) B
- 40) E
- 41) E
- 42) D
- 43) FALSE
- 44) A
- 45) D
- 46) C