Chapter 02
Microscopy

Fill in the Blank Questions

1. The _____ is the point at which a lens focuses parallel beams of light.
focal point

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.01.02 Correlate lens strength and focal length
Section: 02.01
Topic: Microscopy

2. The _____ is the distance between the center of a lens and the point at which it focuses parallel beams of light.
focal length

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.01.02 Correlate lens strength and focal length
Section: 02.01
Topic: Microscopy

True / False Questions

3. Light rays are refracted (bent) when they cross the interface between materials with different refractive indices.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.01.01 Relate the refractive indices of glass and air to the path light takes when it passes through a prism or convex lens
Section: 02.01
Topic: Microscopy

Multiple Choice Questions

4. Confocal microscopes exhibit improved contrast and resolution by
A. illumination of a large area of the specimen.
B. blocking out stray light with an aperture located above the objective lens.
C. use of light at longer wavelengths.
D. use of ultraviolet light to illuminate the specimen.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

5. A 30× objective and a 20× ocular produce a total magnification of
A. 230×.
B. 320×.
C. 50×.
D. 600×.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

6. A 45× objective and a 10× ocular produce a total magnification of
A. 900×.
B. 55×.
C. 450×.
D. 145×.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

7. A microscope that exposes specimens to ultraviolet, violet, or blue light and forms an image with the light emitted at a different wavelength is called a _____ microscope.
A. phase-contrast
B. dark-field
C. scanning electron
D. fluorescence

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

8. Immersion oil can be used to increase the resolution achieved with some microscope lenses because it increases the _____ between the specimen and the objective lens.
A. optical density
B. refractive index
C. optical density and refractive index
D. neither optical density nor refractive index

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.01.01 Relate the refractive indices of glass and air to the path light takes when it passes through a prism or convex lens
Section: 02.01
Topic: Microscopy

True / False Questions

9. A substage condenser is used to focus light onto the specimen, which increases the resolution of a light microscope.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

Fill in the Blank Questions

10. The _____ is the distance between the specimen and the objective lens when the specimen is in focus.
working distance

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

11. The useful magnification of a light microscope is limited by the _____ of the light source being utilized.
wavelength

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

12. The special dyes used in fluorescence microscopy that absorb light at one wavelength and emit light at a different wavelength are called _____.
fluorochromes

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

13. In order to view a specimen with a total magnification of 400×, a _____ objective must be used if the ocular is 10×.
40×

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

True / False Questions

14. Confocal microscopes, in combination with specialized computer software, can be used to create three-dimensional images of cell structures.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

15. A light microscope with an objective lens numerical aperture of 0.65 is capable of allowing two objects 400 nm apart to be distinguished when using light with a wavelength of 420 nm.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

16. Resolution improves when the wavelength of the illuminating light decreases.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

17. Immersion oil is used to prevent a specimen from drying out.
FALSE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

18. It is possible to build a light microscope capable of 10,000× magnification, but the image would not be sharp because resolution is independent of magnification.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

19. Immersion oil increases the amount of light entering the objective lens.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

Multiple Choice Questions

20. If the objective lenses of a microscope can be changed without losing focus on the specimen, they are said to be
A. equifocal.
B. totifocal.
C. parfocal.
D. optifocal.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

21. An instrument that magnifies slight differences in the refractive index of cell structures is called a (n) _____ microscope.
A. phase-contrast
B. electron
C. fluorescence
D. densitometric

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

22. The instrument that produces a bright image of the specimen against a dark background is called a (n) _____ microscope.
A. phase-contrast
B. electron
C. bright-field
D. dark-field

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

23. As the magnification of a series of objective lenses increases, the working distance
A. increases.
B. decreases.
C. stays the same.
D. cannot be predicted.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.01.02 Correlate lens strength and focal length
Section: 02.01
Topic: Microscopy

24. Prior to staining, smears of microorganisms are heat-fixed in order to
A. allow eventual visualization of internal structures.
B. ensure removal of dust particles from the slide surface.
C. attach it firmly to the slide.
D. create small pores in cells that facilitates binding of stain to cell structures.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.01 Recommend a fixation process to use when the microbe is a bacterium or archaeon and when the microbe is a protist
Section: 02.03
Topic: Preparing Microscopy Specimens

25. Acid-fast organisms such as *Mycobacterium tuberculosis* contain _____ constructed from mycolic acids in their cell walls.
A. proteins
B. carbohydrates
C. lipids
D. peptidoglycan

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.02 Bacteria have unique cell structures that can be targets for antibiotics, immunity and phage infection.
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Mycobacteria
Topic: Preparing Microscopy Specimens

26. In the Gram-staining procedure, the primary stain is
A. iodine.
B. safranin.
C. crystal violet.
D. alcohol.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

27. In the Gram-staining procedure, the decolorizer is
A. iodine.
B. safranin.
C. crystal violet.
D. ethanol or acetone.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

28. In the Gram-staining procedure, the counterstain is
A. iodine.
B. safranin.
C. crystal violet.
D. alcohol.

ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Identifying Microorganisms
Topic: Preparing Microscopy Specimens

29. In the Gram-staining procedure, the mordant is
A. iodine.
B. safranin.
C. crystal violet.
D. alcohol.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

30. After the primary stain has been added but before the decolorizer has been used, gram-positive organisms are stained _____ and gram-negative organisms are stained _____.

A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

31. After the decolorizer has been added, gram-positive organisms are stained _____ and gram-negative organisms are stained _____.

A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

32. After the secondary stain has been added, gram-positive organisms are stained _____ and gram-negative organisms are stained _____.
A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

33. If the decolorizer is left on too long in the Gram-staining procedure, gram-positive organisms will be stained _____ and gram-negative organisms will be stained _____.
A. purple; blue
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

34. If the decolorizer is not left on long enough in the Gram-staining procedure, gram-positive organisms will be stained _____ and gram-negative organisms will be stained _____.

A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

35. Which of the following is considered to be a differential staining procedure?
A. Gram stain
B. Acid-fast stain
C. Both Gram stain and Acid-fast stain

D. Leifson's flagella stain

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Identifying Microorganisms
Topic: Preparing Microscopy Specimens

36. Basic dyes such as methylene blue bind to cellular molecules that are
A. hydrophobic.
B. negatively charged.
C. positively charged.
D. aromatic.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Preparing Microscopy Specimens

True / False Questions

37. Gram staining divides bacterial species into two groups based on differences in cell wall structure.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Preparing Microscopy Specimens

38. Negative staining facilitates the visualization of bacterial capsules that are intensely stained by the procedure.
FALSE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Microscopy
Topic: Preparing Microscopy Specimens

39. Negative staining with India ink can be used to reveal the presence of capsules that surround bacterial cells.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Microscopy
Topic: Preparing Microscopy Specimens

40. Mordants increase the binding between a stain and specimen.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

41. In order to stain flagella so that they may be readily observed by light microscopy, it is usually necessary to increase their thickness.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Microscopy
Topic: Preparing Microscopy Specimens

Fill in the Blank Questions

42. The procedure in which a single stain is used to visualize microorganisms is called _____ staining.
simple

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

43. _____ is the process by which internal and external structures of cells and organisms are preserved and maintained in position.
Fixation

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.01 Recommend a fixation process to use when the microbe is a bacterium or archaeon and when the microbe is a protist
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Preparing Microscopy Specimens

44. Thin films of bacteria that have been air-dried onto a glass microscope slide are called _____.
smears

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

45. A procedure that divides organisms into two or more groups depending on their individual reactions to the same staining procedure is referred to as _____ staining.
differential

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

Multiple Choice Questions

46. The Gram-staining procedure is an example of _____.
A. simple staining
B. negative staining
C. differential staining
D. fluorescent staining

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

True / False Questions

47. The Gram-staining procedure is widely used because it allows rapid identification of a microorganism with little additional testing.
FALSE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Identifying Microorganisms
Topic: Preparing Microscopy Specimens

Multiple Choice Questions

48. Regions of a specimen with higher electron density scatter _____ electrons and, therefore, appear _____ in the image projected onto the screen of a transmission electron microscope.
A. more; lighter
B. more; darker
C. fewer; darker
D. fewer; lighter

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

True / False Questions

49. Because transmission electron microscopy uses electrons rather than light, it is not necessary to stain biological specimens before observing them.
FALSE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
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Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

50. Scanning electron microscopes bombard specimens with a stream of electrons; however, the specimen image is produce by electrons that are derived from atoms of the specimen itself rather than by the electrons used to bombard the specimen.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

51. It was possible to view viruses only after the invention of the electron microscope because they are too small to be seen with a light microscope.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy

Fill in the Blank Questions

52. An electron microscope uses _____ lenses to focus beams of electrons onto a specimen.
magnetic

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Section: 02.04
Topic: Microscopy

Multiple Choice Questions

53. Scanning electron microscopy is most often used to reveal
A. surface structures.
B. internal structures.
C. both surface and internal structures simultaneously.
D. either surface or internal structures, but not simultaneously.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy

54. Small internal cell structures are best visualized with a
A. light microscope.
B. dark-field microscope.
C. transmission electron microscope.
D. flagellar microscope.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Bacterial Cellular Morphology
Topic: Microscopy

55. In transmission electron microscopy, spreading a specimen out in a thin film with uranyl acetate, which does not penetrate the specimen, is called
A. freeze-etching.
B. simple staining.
C. shadow staining.

D. negative staining.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

Fill in the Blank Questions

56. _____ breaks frozen specimens along lines of greatest weakness, often down the middle of lipid bilayer membranes so that they may be observed by transmission electron microscopy.
Freeze-etching

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

57. The _____ microscope is capable of atomic resolution of specimens, even when they are immersed in water.
Scanning tunneling

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Section: 02.05
Topic: Microscopy

58. The designer of the first transmission electron microscope, _____, was awarded the 1986 Nobel Prize in physics.
Ernst Ruska

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: History of Microbiology
Topic: Microscopy

Multiple Choice Questions

59. Atomic force microscopes use a scanning probe that maintains a fixed distance from the surface of the specimen. It is useful for specimens that
A. do not conduct electricity well.
B. have extremely uneven surfaces.
C. both do not conduct electricity well and have extremely uneven surfaces are correct.
D. neither do not conduct electricity well nor have extremely uneven surfaces is correct.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Section: 02.05
Topic: Microscopy

True / False Questions

60. Scanning tunneling electron microscopes create a three-dimensional image of specimens at atomic level resolution.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Section: 02.05
Topic: Microscopy

Multiple Choice Questions

61. If immersion oil was replaced with water, what would happen?
A. The refractive index would increase, improving resolution.
B. The refractive index of water would be greater than air but less than oil, improving resolution less than oil.
C. The refractive index of water would be less than that of air, decreasing resolution.
D. There would be no difference.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

62. As the resolution of a microscope system improves, the size of the smallest object that can be seen clearly
A. is larger.
B. is smaller.
C. is not affected.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Section: 02.02
Topic: Microscopy

63. If you forgot to heat fix a smear before doing a Gram stain, which of the following might occur?
A. The stains would not adhere to the bacteria.
B. The smear may not adhere to the slide.
C. The decolorization step of the Gram stain would not work properly.
D. Gram-positive and Gram-negative bacteria would both stain purple.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.01 Recommend a fixation process to use when the microbe is a bacterium or archaeon and when the microbe is a protist
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

64. A specimen has been prepared for viewing with a transmission electron microscope, using uranyl acetate as a negative stain. The area stained by the uranyl acetate will be _____ electron dense compared to specimen itself.

A. more
B. less
C. equally

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

65. If you forgot the decolorization step while performing a Gram stain, which outcome would you expect?

A. Gram-positive bacteria would stain pink.
B. Gram–negative bacteria would stain purple.
C. Gram-negative bacteria would be unstained.
D. Gram–positive bacteria would be unstained.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

66. If you forgot to apply the safranin counterstain while performing a Gram stain, which outcome would you expect?

A. Gram-positive bacteria would stain pink.
B. Gram-negative bacteria would stain purple.
C. Gram-negative and Gram-positive bacteria would be unstained.
D. Gram-negative bacteria would be unstained.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

67. Which type of microscopy would be preferred for creating a three dimensional view of the distribution and arrangement of flagella on a bacterial cell surface?

A. Bright-field microscopy
B. Scanning electron microscopy
C. Fluorescence microscopy
D. Transmission electron microscopy

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Learning Outcome: 02.05.02 Evaluate light microscopy, electron microscopy, and scanning probe microscopy in terms of their uses, resolution, and the quality of the images created
Section: 02.04
Section: 02.05
Topic: Microscopy

68. Which type of microscopy would be preferred for showing fine internal detail of the eukaryotic organelles?

A. Bright-field microscopy
B. Scanning electron microscopy
C. Fluorescence microscopy
D. Transmission electron microscopy

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Learning Outcome: 02.05.02 Evaluate light microscopy, electron microscopy, and scanning probe microscopy in terms of their uses, resolution, and the quality of the images created
Section: 02.04
Section: 02.05
Topic: Microscopy

69. You are researching the structure of a transmembrane protein. Which type of microscopy would provide you the best view of this protein?

A. Bright field microscopy
B. Scanning electron microscopy
C. Transmission electron microscopy
D. Atomic force microscopy

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Learning Outcome: 02.05.02 Evaluate light microscopy, electron microscopy, and scanning probe microscopy in terms of their uses, resolution, and the quality of the images created
Section: 02.05
Topic: Microscopy