

## Tabular Analysis

For questions 1–13, fill in the blanks to explain the structure of words describing energy, electrons, and carbon when it comes to nourishing microorganisms (e.g., photolithoautotroph, heterotroph, chemoorganoheterotroph).

Structure = (1.) Source + (2.) Source + (3.) Source + Suffix

(1.) Source	(2.) Source	(3.) Source	Suffix
photo- = (4) (5)- = (6) ∅- = unspecified	(7)- = inorganic (8)- = (9) ∅- = unspecified	(10)- = (11) (lit. self) (12)- = organic (lit. different) ∅- = unspecified	-troph = nourishment

At least (13.) source word(s) must be specified.

For questions 14–17, fill in the blanks to explain why organoautotrophs don't exist. If a blank should not contain any words, use ∅. Note that (14) is a molecule.

(14) is (15) a(n) (16) (17) source

### MCQs

18: Which is spelled correctly?

- a: *Saccharomyces cerevisae*    b: *Escherichia coli*  
c: *Nanochloropsis spp.*    d: *Rickettsia rickettsi*

19: Which is false?

- a: DnaA activates initiation of DNA replication in bacteria  
b: DNA polymerase synthesizes DNA by the process of replication  
c: DNA unwinding element is the start point for strand separation and unwinding of the DNA double helix  
d: origin of replication is where replication is inhibited

20: Which component of a bright-field microscope allows the observer to view the specimen?

- a: Stage    b: Eyepiece  
c: Revolving nosepiece    d: Condenser

21: Which is most accurate?

- a: SEM produces 2D images    b: SEM uses light  
c: TEM produces 3D images    d: TEM uses electrons

22: What part of a bright-field microscope controls the intensity of the light?

- a: Illuminator    b: Stage clips  
c: Diaphragm    d: Light adjuster

23: If 10 colonies are formed from a solution that had 9 mL of water added to it three times, then how many colonies were in the original sample?

- a: 280 colonies    b: 7290 colonies  
c: 10000 colonies    d: Cannot determine

24: Which has the largest genome size?

- a: Major Prion Protein  
b: *Mycobacterium leprae*  
c: *Microcystis aeruginosa*  
d: *Mycobacterium tuberculosis*

25: Suppose that a population of bacteria over time can be expressed in an equation of the form  $y = L/(1 + be^{(-kt)})$ . What is the carrying capacity of this population?

- a: b    b: k    c: L    d: t

26: Which is not a mechanism of horizontal gene transfer?

- a: Conjugation    b: Conjunction  
c: Transduction    d: Transformation

## Microbe Mission TEST

27: When was *Pyrococcus furiosus* first discovered?

a: 1850      b: 1918      c: 1986      d: 2020

28: On what polysaccharide was *Pyrococcus furiosus* found to grow on?

a: cellulose    b: chitin      c: starch      d: DNA

29: How many steps does a dichotomous key for 8 species have?

a: 3            b: 4            c: 7            d: 8

30: What is the function of the flagellum?

a: nutrient intake                      b: cell movement

c: quorum sensing                      d: reproduction

31: Which do capnophiles best thrive in?

a: glucose    b: oxygen    c: carbon dioxide    d: water

32: How many molecules of ATP are produced by oxidative phosphorylation?

a: 0            b: 2            c: 4            d: 32

33: What does the S in 80S stand for?

a: Subunits                      b: Seconds

c: Svedbergs                      d: Synthesis

34: Which subunits does an 80S ribosome contain?

a: 30S and 50S                      b: 30S and 60S

c: 40S and 50S                      d: 40S and 60S

35: Which has a 70S ribosome?

a: *Escherichia coli*                      b: Lambda phage

c: *Saccharomyces cerevisiae*                      d: T4 phage

36: Which cannot be gram-stained well?

a: *Mycobacterium leprae*                      b: *Microcystis*

*aeruginosa*

c: *Staphylococcus aureus*                      d: *Helicobacter pylori*

37: Which is not used in soy sauce fermentation?

a: *Candida spp.*                      b: *Lactobacillus spp.*

c: *Torulopsis spp.*                      d: *Zygosaccharomyces rouxii*

38: Which allows for a DNA virus to deliver its genetic material into a host cell?

a: capsid                                      b: pins

c: tail fibers                                      d: tail sheath

39: Which type of microscopy produces images with light backgrounds?

a: Bright field

b: TEM

c: Confocal

d: Fluorescence

40: Which is not a selective medium?

a: Eosin methylene blue

b: Terrific Broth

c: X-gal plates

d: Xylose lysine

41: Which is not a differential medium?

a: MacConkey agar

b: blood agar

c: YM (yeast and mold)

d: X-gal plates

42: Which is an example of degerming for use on living tissue?

a: Cleaning public restrooms

b: Handwashing

c: Preparation of surgical equipment;

d: Cleaning skin broken due to injury

43: What is the Svedberg unit most closely based on?

a: meter

b: second

c: kilogram

d: ampere

44: Which one lacks organelles?

a: *Paramecium spp.*

b: *Nannochloropsis spp.*

c: *Microcystis aeruginosa*

d: Major Prion Protein

45: Which is false?

a: Most bacterial chromosomes are circular and contain a single origin of chromosomal replication (oriC).

b: The first step of any bioremediation program is to develop a conceptual site model (CSM) to evaluate the potential for applying bioremediation at a site.

c: Lambda phage has been used heavily as a model organism and has been an excellent tool first in microbial and molecular genetics.

d: In a Winogradsky column, aerobic sulfate reducers produce hydrogen sulfide.

46: Which of the following is found in the outer membrane of Gram-positive but not Gram-negative bacteria?

a: Lipopolysaccharide

b: Lipoprotein

c: Phospholipid

d: Teichoic acid

## Microbe Mission TEST

47: In what stage do bacterial cells undergo involution?

a: Stationary

b: Exponential

c: Log

d: Death

### FRQs

48: What type of symbiotic relationship typically takes place between barnacles and a whale?

49: How many steps are there in the gram staining procedure?

50: What part of the microscope controls how much light illuminates the specimen?

51: What rare element is found in enzymes used by *Pyrococcus furiosus*?

52: What organelle allows molecules to enter and exit cells?

53: Which type of microscopy is known for producing halos of light around its observed specimens?

54: Which microorganism causes malaria?

55: Which sex of mosquito transmits malaria?

56: Which bacterial shape is known for being helically coiled?

57: What gas do yeast produce that form holes in bread?

58: How do septate and coenocytic hyphae differ? [2]

59: Why is it more beneficial for viruses under UV conditions to undergo lytic cycle replication rather than lysogenic cycle replication? [2]

60: What is the difference between a monophyletic, paraphyletic and a polyphyletic group on a phylogenetic tree? [5]

61: In virus replication, what is integration?

62: What is the function of the patch stop in dark field microscopy?

63: In nitrogen fixation, N<sub>2</sub> is converted into NH<sub>3</sub>, NH<sub>4</sub><sup>+</sup>, or NO<sub>3</sub><sup>-</sup>. Name each of these molecules. [4]

64: What type of electron microscopy would be better to observe the outer layer of *M. leprae* and why? [2]

65: What is the function of carboxysomes?

66: What does it mean for *M. tuberculosis* and *M. leprae* to be obligate intracellular pathogens?

67: Sort the bacterial shapes {bacillus, vibrio, coccus, spirochete} from greatest to least SA:V ratios, and explain why all bacteria of these shapes are relatively small in general. [3]

68: What does PCR stand for? Describe each of its three steps. [7]

69: What would happen if crystal violet is added after Gram's iodine in the gram staining procedure? [3]

70: Why is being a carrier for sickle-cell anemia an advantage in developing resistance to malaria? [2]

71: What four elements is an aminoglycoside reaction likely to involve? [2]

72: Why is it easier to count the number of colony-forming units when using a spread plate method compared to a pour plate method?

73: Is *Pyrococcus furiosus* likely to cause disease in humans based on its kingdom? Based on the temperature in which it optimally grows? Briefly explain for each. [3]

74: Which of the following among transduction and transfection involves the use of a virus? Briefly describe the other mechanism. [2]

75: Why doesn't it make sense for a bacterial population in an exponential growth phase to form endospores? [2]

76: Suppose that infrared radiation was emitted toward this bacterial population. Why is this a concern? Does infrared radiation emit more or less energy compared to visible light? [2]

77: Would *Thermus aquaticus* or *Pyrococcus furiosus* be more likely to survive the conditions in the previous question? Briefly explain. [2]

78: Explain the purpose of fermentation and where it occurs in a cell. State whether it is aerobic or anaerobic. [3]